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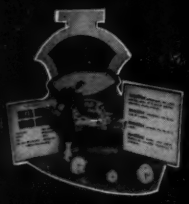

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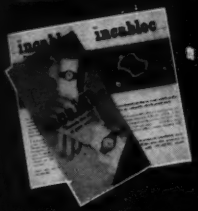

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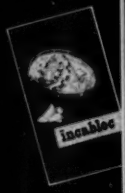

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Volume 23, No. 1

January, 1956

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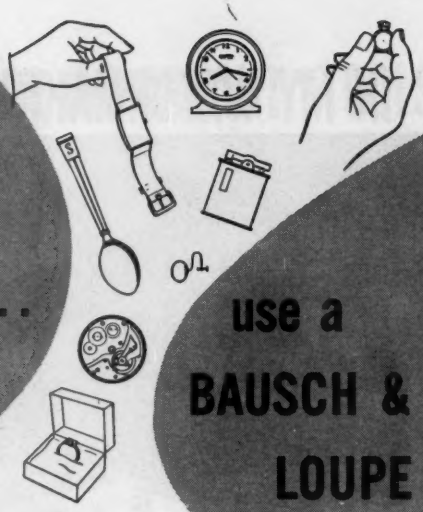

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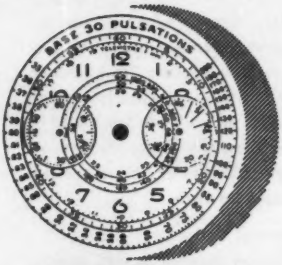

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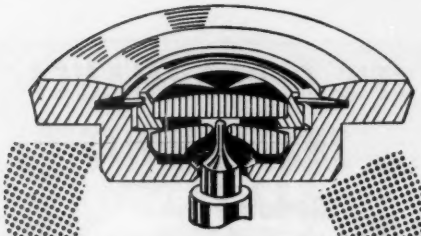

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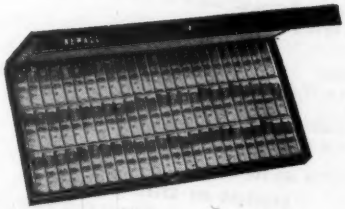

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Before going on to consider later variations, there are a few points to be noted about the arrangement of *Figure 1, pg. 16.*

First, it is desirable that the path *AB* of the tooth tip should cut the dead face approximately at right angles, because this makes the action more direct and effective. It is not necessary that the dead face should be *exactly* at right angles to the tooth path, though some makers have gone to great pains to make it so. In practice, any angle between 80° and 100° is perfectly satisfactory, for the mathematical reason that the sine of any such angle differs from sine 90° by less than 1½ per cent.

There is an easy way of laying out the escapement so as to be sure of getting this 90° angle. If *X* be the pallet pivot, and *Y* the scape wheel pivot *(Figure 2, pg. 16)*, draw a circle *XABY* on *XY* as a diameter.

THE BROCOT ESCAPEMENT

Part II—A. L. Rawlings

WHEN honest George Graham, clockmaker and Fellow of the Royal Society, invented the deadbeat escapement a little over 200 years ago, he originated an idea which later inspired an Englishman, Thomas Mudge; a Frenchman, Achille Brocot; and an American, Charles E. DeLong. Each of these three later designed an escapement akin to Graham's, but different in detail.

The essence of Graham's deadbeat escapement appears in *Figure 1,* which shows a tooth *T,* of the scape wheel resting on the "dead" face of the pallet *P.* This face is called dead because it is shaped as part of a circle with center at the pallet pivots, so that further swinging of the pendulum and pallet causes no motion of the scape wheel; the wheel does not recoil as it did in the older verge and anchor escapements, but remains still or dead until the sloping impulse face *I* of the pallet comes under the wheel tooth.

Then, if the scape wheel touches the pallets anywhere on this circle, we shall get the right angle we want. With a small scape wheel, we shall have the pallet at *B* at the end of a long arm *XB.* With a large scape wheel, we have the pallet at the end of a short arm *XA.* The question is, are long pallet arms better or worse than short ones.

This has been debated for over a century with no very decided answer emerging, except that in commercial clocks, short pallet arms seem to be favored. Let us suppose that the distance between centers—scape wheel to pallet arbor—is fixed and that we have a fixed number of 30 scape teeth. Also, let us decide that while the wheel is sliding down the sloping face and giving impulse, the pallets and pendulum shall swing through an angle of 2°. We make the thickness of the pallets equal to half the pitch of the teeth, less a little for clearance. So with a large wheel and short pallet arms, the pallets will be thick; with a small wheel and long pallet arms, the pallets will be thin.

By J. E. Coleman and A. L. Rawlings

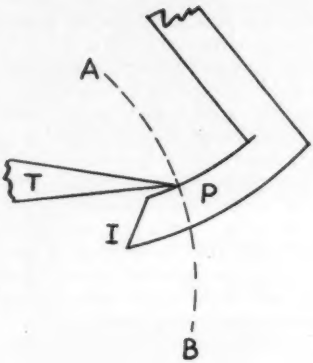


Fig. 1

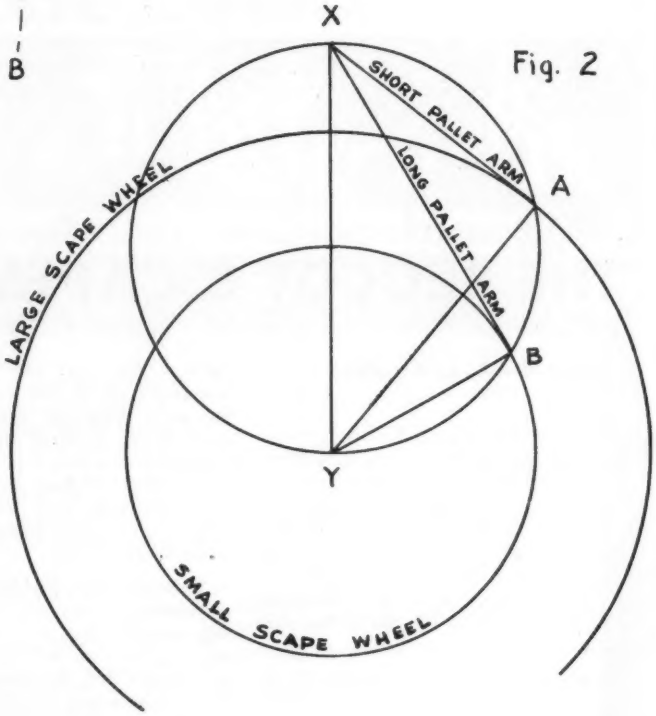


Fig. 2

Figure 3 shows that the short pallets have very steep impulse faces, while the long pallets have very unsteep faces, as seen at the bottom of the figure. This last is evidently not an efficient arrangement. For the same driving force from the train, the pressure of the scape teeth on the pallet will be greater with a small scape wheel than with a big one. The long pallets go with a small wheel and the frictional drag extends over a long surface.

On the other hand, the short pallets at the top of *Figure* 3 are perhaps a little too steep for satisfactory working, because a little side play in the pivots might allow the impulse face to slip away without receiving much impulse from the wheel.

If the impulse is all to be given while the pendulum swings through a small arc of, say 2°, the pallet faces must be steeper than they would be for a greater impulse arc. Hence, a clock with a one-second

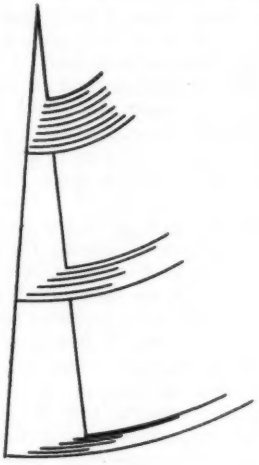
pendulum swinging a total arc of 3° or 4° may have longer pallet arms than a shelf clock with 6° or 8° pendulum swing; and the longer the pallet arms, the more teeth of the scape wheel are included between them.

All of this was doubtless known to Thomas Mudge when in 1758 he made his first watch with a lever escapement—the forerunner of all modern watches. *Figure 4* shows this escapement copied from Major Chamberlain's drawing in his book, "It's About Time."

The pallet pivot is at *P* and the wheel pivot at *W*, so you see that Mudge arranged the point of contact between wheel tooth and pallet to be at *C* on the circle whose diameter is *PW*.

The dead face in this Mudge escapement is very short between the corner of

Fig. 3



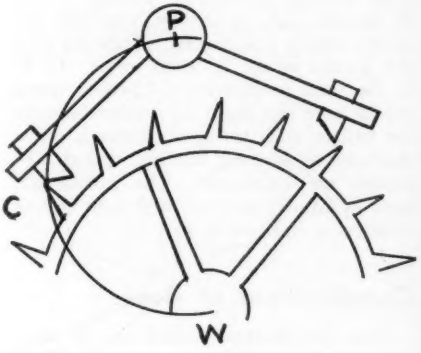


Fig 4

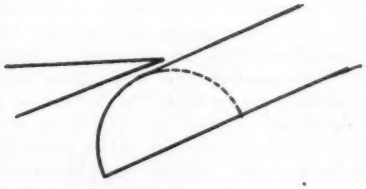


Fig. 5

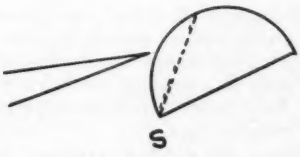


Fig. 6

the impulse face and the clamp that holds the pallet stone. In a pendulum clock, the dead face has to be long enough to allow the pendulum to swing a considerable distance after receiving impulse. Mudge's lever and pallets had to be stopped or banked just after the end of the impulse —in fact it appears that the clamp banks on the tips of the wheel teeth. Mudge might have copied Graham and curved the dead face, but he realized that for such a short length, a straight line would be indistinguishable from the curve, so he very wisely made the dead face straight.

Graham confined his impulse to about 2° of arc which is suitable for a long pendulum, and therefore he required long pallets which in practice embraced 9½ of the 30 teeth of the wheel. Mudge's lever receives an impulse through 5° of its motion and, as already explained, requires shorter pallet arms, embracing only 4½ pitches of the 20-tooth wheel. To be in the same proportion, a 15-tooth wheel would have less than 3½ pitches between the pallets, and this arrangement is sometimes found in lever watches, though 2½ pitches are commoner. The proportions used by Mudge are followed with trifling differences right up to this day.

Complications of slopes

One complication found in all these escapements needs to be noticed. Whatever slope is built into the impulse face of the pallets, it does not remain constant in relation to the scape tooth throughout the impulse. At the exit pallet, from the moment impulse begins, the pallet face gets steeper and steeper as the tooth travels down. At the entering pallet, the steepness is a maximum at the beginning of the impulse and gets less and less as the impulse proceeds. This change in slope is of course a result of the angular motion of the pallets. In a clock escapement where the pallet motion during impulse is only 2° or 3° the change is not noticeable. But the lever in a modern watch moves nearly 10° and causes a considerable change in the impulse slope.

When the watch is working, the scape wheel which has been at rest on the dead face of a pallet, is suddenly released and expected to follow round the sharp angle between the dead and impulse faces without losing contact. Many people think that the sharp angle is a mistake and would like to see a gentle change from dead to impulse as shown in *Figure 5*.

From this, it is an easy transition to the shape of the Brocot pallets, as we have only to cut the end off the slab jewel by following the dotted line to have a half-round Brocot pallet. Incidentally, we shall have cut the dead face off the pallet, but we have a very good substitute in the radial front flank of the tooth. The slope of the impulse face of the pallet, because of its cylindrical shape, is not affected by the angular motion of the pallet arm as it is in the Graham escapement, but increases gradually from nothing at the beginning to a maximum at the end of the impulse for both entrance and exit pallets, and this leads to a nice, gentle acceleration of the scape wheel which makes for efficiency in action. On the other hand, the curved impulse face is longer than the straight one, shown dotted in *Figure 6*, by about 10 per cent, so there is a little more friction with the former. This may be the reason why some repairers cut flats on Brocot pallets, but the benefit of such a procedure is doubtful in any case, and unless the new flat surface is given a smoothness and polish at least as good as that of the original cylindrical stone, it will do more harm than good. Moreover, the sharp angle at *S* is easily chipped.

Small 8-day French drum clocks, whether they have Brocot escapements or the conventional type, call for rather special attention when they come in for repair or cleaning. Their mainsprings are about the same size as those of a 2-day marine chronometer, but they drive the clock for a week at one winding with a reserve for a second week if the owner forgets to wind them. One great advantage of this small power is that the clocks have a very quiet tick, which caused them to be very popular for bedrooms and sitting rooms. On the other hand, they are liable to stop unless they are carefully put in beat. To do this, it is not necessary to bend the crutch, as the crutch is mounted on the pallet arbor by light friction only, and can easily be turned. The simplest way to adjust the beat is to push the crutch over until the pallets bottom on the scape wheel, and then push

it a trifle further against the friction. The whole operation can be done by feel without taking the movement out of the case.

We have known several French mantel clocks with Brocot escapements that have gone for 30 to 40 years with two or three cleanings, and are still working. If a particular specimen seems to have insufficient power, it is possible, but unlikely, that the mainspring is at fault. If the pivots and pallets are clean and the train runs free, the trouble is almost certainly due to one of the following causes:

1. The double-spring suspension is kinked or otherwise out of order.

2. The pendulum or crutch touches the bell or gong.

3. The pendulum rod binds in the crutch slot *when the clock is in its usual working position.* Many shelves slope forward or backward, and a clock that goes well enough on a level bench, stops when it is put on a sloping shelf. The slot in the crutch should have a little play on the pendulum rod, and there should be a drop of oil where they make contact. If the rod bears hard against the end of the crutch slot, the clock is sure to stop. The remedy is to bend the crutch closer to the clock plate.

4. A striking French clock will generally stop between 12 and 1 o'clock if the strike is unwound or out of order. The striking rack drops to the bottom of the hour snail, and if it is not lifted by striking 12, the hour wheel will be blocked. If the hands are then forcibly set forward, the teeth of the hour wheel will be broken or bent.

A Brocot escapement has two adjustments which inexperienced and rash repairers sometimes try to alter with bad results. The forked brass frame which carries the pallet stones can be used to adjust the distance straight across from one pallet to the other. Change in this adjust-

Fig. 7

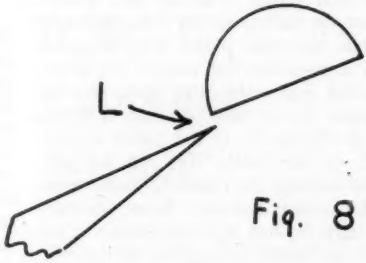


Fig. 8

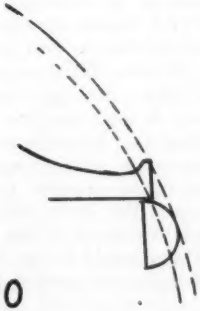


Fig. 10

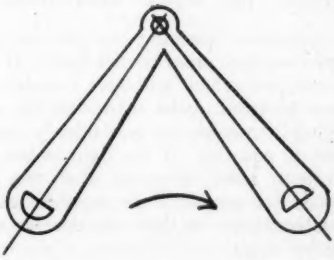


Fig. 9

ment in most cases is made by bending the frame, which is slit up to make it easier. In a few clocks, a screw is provided for adjusting this distance and this makes it much easier, as only a small change is ever required. To check the adjustment, put a soft cork wedge or a fold of tissue paper between the crutch and the back plate. Then, with power on the scape wheel, move the crutch slowly until one tooth just escapes from the entrance pallet. The exit pallet should then lock its tooth with the tip just in the middle of the curved face of the stone, as in *Figure 7*. If the tooth projects beyond this mid-point on repeated trial (don't trust to a single try), the pallets should be spread wider.

The second adjustment of the escapement is in the center distance, scape wheel to pallets. The hole for the front pivot of either the wheel or pallets is in an eccentric bush, which can be turned with a strong screw driver to vary the distance.

To check this adjustment, wedge the crutch as before, and move it until the entering pallet is deep between two teeth and the exit pallet clear of the wheel. Then turn the pallets slowly the other way and watch the exit pallet with a weak loupe as it re-enters the wheel. Its lower side should just clear the back of the tooth below it, so that you can just see light at *L, Figure 8*. If the pallet scrapes the back of the tooth, this can be prevented by turning the eccentric bush to increase the center distance. Now, increasing the light on one side diminishes it on the other, so before turning the bush, check the entering pallet by just the same method and see how much you can afford there.

Adjust for equal clearance

Adjust, if possible, to get the lights equal on both sides for all teeth. If there is a bent tooth, it will give a wider clearance with one pallet than with the other, and if it touches on one side, it must be bent to equalize. If the light is too small on both sides, it means that the pallet stones are set too close together, or they are too large, or they are not set at the correct angle.

When new stones are required, their full diameter should be a little less than the space between the tips of two teeth on the scape wheel. If they are too large, they will not give clearance as described in the last paragraph; if too small, there will be excessive drop and loss of power. The stones should be cemented into the pallet frame with the flat face looking in the same direction as the wheel turns, and at right angles to a line from the center of the stone to the pallet arbor (see *Figure 9*). Take care that they are upright in the frame.

DeLong escapement

In 1915, Major Paul Chamberlain published, in the *American Jeweler,* a description of the watch escapement proposed by Mr. Charles DeLong. The DeLong pallets look just like a Brocot pallet assembly except that they span only 2½ pitches of the scape wheel and the stones are set the opposite way up, with the flat sides acting as impulse faces. The scape wheel has club teeth of the usual shape and in nearly every respect the action is identical with that of the ordinary watch lever.

The only difference is this: In the conventional watch escapement, the wheel locks on the straight face of a pallet stone. On the exit side, the draw increases as the lock is made deeper, but on the entry side, it decreases. In the DeLong, the tooth locks on the cylindrical face (see *Figure 10*) with the result that, first, angular motion of the pallets does not affect the draw, and second, the draw angle gets greater as the lock gets deeper and the tooth reaches further around the cylinder.

It was supposed by Chamberlain that these conditions reduced considerably the resistance to unlocking and allowed the use of a weaker mainspring. Several hundred watches on this plan were made up by Illinois Watch Company, Hamilton and others, and gave satisfactory performance. It appears that the main reason against the adoption of the DeLong escapement in watches was the fact that the construction requires the scape wheel to lie over the lever and this adds to the overall thickness of the watch.

There would be no advantage in using DeLong's arrangement for a clock where no draw is needed, but the nearest approach to a dead action that can be contrived.

HELPFUL HINTS FOR SAPPHIRE SELLING

HOW many times have you wished on a star—or for a star? Of course, you can never pluck a star from the sky, but you can do the next best thing by wearing a star sapphire. You can watch your private star in this softly colored gem as it comes and goes, now shining brightly at the surface, now gleaming gently from the depths of the stone. The ancients who found the first star sapphire believed that surely the falling stars of heaven were caught in the satiny depths of the stone. And on through the ages there has been built up a shimmering backdrop of superstition and lore around these fabulous gems.

Throughout time star sapphires have been sought and cherished. Our early ancestors desired these gems for the mystic powers that they attributed to them. They believed that the moving star of the stone would protect them from peril and safeguard their peace and security. Kings often wore them as a powerful defense from harm, because the star sapphire was said to protect the wearer from capture by his enemy and to attract divine favor. In fact, star sapphires were standard gems for the crowns of kings and emperors.

Sapphire was also supposed to have therapeutic powers. Rings of sapphire were used to remove impurities from the eyes and as a protection against poison. According to legend, if a poisonous spider or reptile were placed in the same glass with a sapphire, rays from the gem would cause it to die. Folklore tells how sapphire will "cool a fevered brow, calm excited nerves, benefit the heart, and reconcile disorders." Even as late as the 18th century, a potion of powdered sapphire was thought to relieve insanity.

Ancient Persians revered the sapphire as a symbol of truth, constancy and virtue. They believed that the earth was supported by a sapphire column that colored the sky by its reflection. In many legends, the star stone is connected with Christmas and the Star of Bethlehem, with the three

lines that form the star representing Faith, Hope, and Destiny. It was also regarded as a potent love charm that would attract and hold the love of the one on whom it was bestowed. This may be the reason that star sapphires were for many years the traditional engagement stone of European nobility. That famous beauty, Helen of Troy, wore a superb star sapphire to which she attributed all her conquests.

Orientals to this day believe that the star stone will ward off evil and bring good fortune, even if the gem has since passed into other hands. According to an old story, Sir Richard Burton, a great traveler in the Orient, owned a beautiful star sapphire. Fame of his wonderful good-luck gem spread and wherever he went, his every need was cared for, service was prompt, and the best horses were at his disposal. All this in return for one glimpse of his magnificent luck-bringing gem.

Most natural star sapphires are grey, ranging from a milky-white to a grey-blue. Deep blue star sapphires are more often talked about than seen. The most desirable and precious variety—a velvety, cornflower blue gem—is found in Kashmir, India. The mines there are nearly exhausted and a truly fine specimen commands a high price—if it ever gets to the outside world at all. These gems are particular favorites of maharajahs and most of the best stars are in the vaults of these wealthy princes.

Fig. 1—Here is an example of an exceptionally large, fine quality synthetic star.

An incident that occurred in 1875 is a perfect example of how jealously the Indian potentates collect and protect star sapphires. In a mountainous district of Kashmir, natives used hard blue pebbles found in the area as flints for making fires. One day an uneducated Buddhist monk found a large vein of this blue material that had been exposed by a landslide. He chipped off bits of the stone and found that he could exchange them for sugar and tobacco. Then he and his fellow monks decided to have an idol for their temple made from the beautiful blue stone. They managed to break off a large piece and took it to the nearest town to have it cut. But the lapidary to whom they brought the stone could not cut it with any of his tools. He showed the curious material to a government official who, in turn, sent it to the Maharajah of Kashmir. At the royal court the blue stone was immediately recognized as sapphire. The prince claimed the whole deposit as his own and set up a strong guard at the site until the sapphire could be removed. This find—today worth more than three million dollars—is still in the possession of the same Indian royal family. Small wonder that few really fine natural star sapphires have ever been seen in this country.

From all this it would seem that, for the average person, wishing for a star sapphire would be just as futile as wishing for a heavenly star. But now, like a wish come true, science has created star sapphires equal to nature's finest. In 1947, after years of research, Linde Air Products Company, a division of Union Carbide and Carbon Corporation, succeeded in growing in the laboratory the first made-made star sapphire.

Linde stars are made from very fine aluminum oxide powder, exactly the same powder you would have if you took a

mined star and crushed it. The powder is fed into the flame of a tiny furnace. As it passes through the very hot flame, it fuses and falls to a pedestal at the bottom of the furnace. There, layer by layer, the crystal grows, just as a stalagmite forms on the floor of a cave. The result is a man-made star sappire that rivals nature's finest. When man-made star sapphires were first displayed to the public, a *Time Magazine* reporter wrote, "Beside these . . . natural stones from the museum looked pallid."

These are not imitations; they are made of the same ingredients that nature used for gems. They have the same hardness and durability, and in all essential respects are identical with mined stars chemically, physically, optically, and in the formation of the star. A jeweler can distinguish a man-made star from a mined star when he examines it under a loupe. The average person can tell the difference by the price. Man-made stars sell for one-fifth the cost of natural stars, and are within the reach of everyone.

Mounted in the latest high fashion designs, they are available in an exciting variety of settings, from dainty rings to magnificent multi-carat show pieces. If you are looking for a gift that is different, you may find the answer in a man-made star sappire. For women there are star-set rings, earrings, pins, and necklaces; for men, rings, cuff-links, and studs. Sapphire is the birthstone for September, so a star sapphire makes a wonderful birthday gift for someone born in that month. As a symbol of love "as eternal as the stars,"

Fig. 2—The star sapphire on the left is a fine natural stone; that on the right is a synthetic star sapphire produced by Linde Air Products Company.

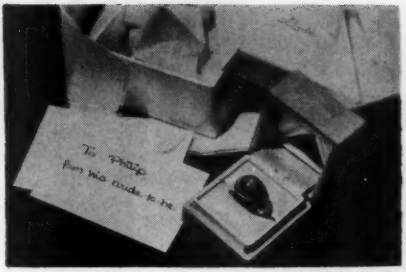


Fig. 3—Men seem to prefer star sapphires because they are distinctive and dignified as well as beautiful and durable.

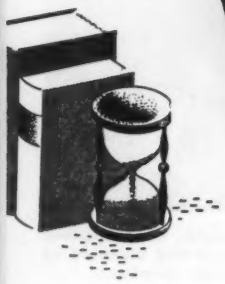
they are often given as engagement and anniversary gifts. Star sapphires are surrounded by so much ancient lore that they are appropriate for almost any occasion.

It is a wonderful feeling to present a gift that has a touch of magic about it, to give someone the delight of opening a package and finding something that is truly fabulous and breath-taking. And remember, tradition has it that the star sapphire is so potent a talisman of good fortune that it continues to exercise its good influence on the original owner even after it has passed into other hands.

Owns Extraordinary Gem

A RECENT VISITOR to Clock Manor in Denver, Colorado, "The Crossroads of Time," was Abdul W. M. Ameer, proprietor of a precious stone mining and cutting company in Colombo, Ceylon. Mr. Ameer, shown at right above with Orville R. Hagans in a Clock Manor museum room, owns the world's only 12-rayed star sapphire.

information PLEASE!



Elements of Good Repair Work

1. What is the correct way to replace a mainspring in a barrel of automatic wind watch with slip end?

2. I have heard that some clock repairmen drill a hole in a Telechron Motor and inject oil or grease into the motor and then seal the hole, thereby making the clock run almost noiselessly and giving it longer life. Does this procedure give lasting results?

3. I have much difficulty in hooking and fastening the coil spring on gong strike levers in the common eight-day strike clock. The spring is thick and strong and stiff. To hook this spring on the gong arbor and keep the levers in proper place while assembling requires much too much time and work. Many of these clocks have been oiled and greased by some member of the family. After this procedure, the pivot holes are prick punched around the pivot holes by old retired person. I find that when they are brought to me for oiling and cleaning, the pivots need smoothing and polishing and several bushings and other repairs. I am now quoting $10 to $15 for this. Some people think I am a robber. It isn't too much, do you think?

4. Is the balance wheel injured or damaged in drawing the temper of a staff so as to cut off the hub? The steel arms get blue. I remove the blue with acid.

5. Why isn't the lower center pivot jeweled when watches have 17 or more jewels? I find that some pivots have cap jewels where the end of pivots don't reach the cap jewel. It seems to me they are therefore useless.

6. How is one to adjust the beat on clocks in which the verge wire (sometimes called crutch) is flat, and thick brass, and hard to bend without danger of bending or breaking the pivot or pallets. I find this mostly in French model clocks.

7. I have much difficulty in making eight-day spring wound clocks run. They often won't run for me after cleaning, smoothing and polishing pivots, and bushing worn pivot holes. I have several auto clocks, mostly Waltham, that I would like to repair. I also have two eight-day lever Seth Thomas clocks cased in fine wood. These clocks are powered with two mainsprings in barrels. What have I neglected doing? I find many watchmakers refuse to work on them.

8. What does Brevet mean? I sometimes find it stamped on the plate of Swiss watches.

INFORMATION PLEASE

Directed by
W. H. SAMELIUS

Chairman, Science of Horology and Technical Advisory Board

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5 Gal. Can: $13.50

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Contains new 16 ounce jar of Ellanar Jewelry Cleaner plus the exclusive safety cleaning tray and brush. The tray makes jewelry cleaning safe and pleasant. All you do is dip and dry

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Ellanar Dip instantly removes tarnish from the finest sterling or silver plate in second's time! No rubbing is necessary.

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L & R Plastic Watch Crystal Cement

Available in L & R's exclusive pinpoint tubes with rubber seal cap and bottles, this cement is unequalled for forming a perfect seal between watch crystal and bezel. Never hardens and cracks, always remains semi-plastic. Does not flake.

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This polish provides quicker action and a longer-lasting lustre It's a gentle, scratch-free cream that never settles out in the bottle Keeps silver bright and shining

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L & R exclusive formula, which is ready to use with iron, torch or match flame, is packed in handy tubes It's an all-purpose, high strength metal solder containing its own flux.

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A little of this famous Rapid Spread Remover removes all, or a good part of the corrosion. Comes in a special dropper bottle!

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WATCHWORD OF THE WATCHMAKER

L & R MANUFACTURING COMPANY 577 Elm Street Arlington, N. J.

9. I can't buy benzine any more. Gasoline is too oily and greasy to clean the hairspring of wrist watches. Hairspring solutions are mostly ether and they evaporate so rapidly that I can't keep it in stock. What solution do you recommend for this work?

ANSWER 1. I cannot give a correct way to replace a mainspring into the barrel for the automatic watch other than that they must be replaced without distorting or kinking the spring. In many cases, the spring can be replaced with the mainspring winder and some manipulation inserting the bridle end into the barrel before releasing the spring from the mainspring winder. Then we find where the bridle is a separate part and can be inserted into the barrel first and then wind the spring into the winder so as to insert the mainspring into the barrel. Many men replace the mainspring by hand, claiming that it is easier and quicker than using a winder. However, there is always the danger of distorting the mainspring. I am inclined to believe that with care, using a mainspring winder is the better way.

ANSWER 2. Many workmen do drill a hole into the motor and inject lubrication, and some will flush out the motor with gasoline before applying the lubrication. This helps to loosen the thick oil and dirt. This method does restore the motor to a longer life if properly done, but as in all cases, the motor will wear out in time. When sealing the hole, do not use any flux containing acid.

ANSWER 3. I know just what you mean when you mention the tension spring that is wrapped about the hammer arbor and then looped around the clock pillar. The best way I have found for replacing the hook end is to assemble the clock complete and then with a small wire having a loop end, insert the loop end of wire between the hammer arbor and pillar, catch the end of the tension spring and pull it through, and then loop the end over pillar.

In fact, you can assemble the complete clock and then the last piece to replace is the hammer. Sometimes you may find it convenient to assemble the clock complete with hammer arbor and tension spring in place, according to how close or what space you find available between the arbor and pillar. Bear in mind that time is worth just so much to you. Whether you are repairing a watch or repairing a clock, if you spend the same amount of time earning $10 to $15 on clock work as you would on watch work, you are very fair in your repair charges.

ANSWER 4. Unless the heat has gotten into the balance wheel, no particular harm has occurred.

ANSWER 5. In many of the Swiss model watches, the opening or the barrel is so large that there is very little material left for the lower center wheel pivot, and it would be practical to insert a center jewel. The jewel would only be a shell and not strong enough to stand any jars or rough usage. It is true that you may find many watches where the end of the pivots do not contact the cap jewel. However, a new law specifies that every jewel must function. Consequently, all watches made and imported must conform to that law.

ANSWER 6. It is so that the crutch for French clocks is made very rigid. And there is danger of causing damage to the escapement when bending. Use precaution when bending such a crutch by using two pairs of pliers. Ordinarily, the crutch is attached to a brass bushing that is fitted to the pallet arbor friction tight, and yet loose enough that it will slip and automatically put escapement in beat if the pendulum is given a severe start. The clocks are made that way purposely. You may have run across a clock where some former workman thought the crutch must be tight like some of our American clocks —and soldered the crutch solid to the pallet arbor.

ANSWER 7. It seems to me you haven't neglected anything, but perhaps you are too anxious to do a good job. Perhaps you overdid it! You may find a tapered pivot that binds in some of the rebushed holes. Perhaps the mainsprings are set or you do not use the proper mainspring lubricant. Is it possible you changed center distances when you bushed the hole? Are you sure you maintained the proper angles when you refinished the balance pivots? Sometimes you have an open

mainspring and as it expands, it is blocked by a pillar or expands against the first wheel pinion. It could be you do not fasten the loop end of mainspring over its proper place so as to cause it to develop away from the first pinion as the spring runs down.

You mention polishing pivots and bushing holes. It might be advantageous to check on the barrel arbor for condition of pivots and bearings, and also for arbor end shake. Make certain the mainsprings are not too wide and bind in the barrel after the cover has been replaced. There is no reason why these clocks cannot be made to run eight days. However, very few of them really keep accurate time for the full eight days.

ANSWER 8. The word Brevet means patented.

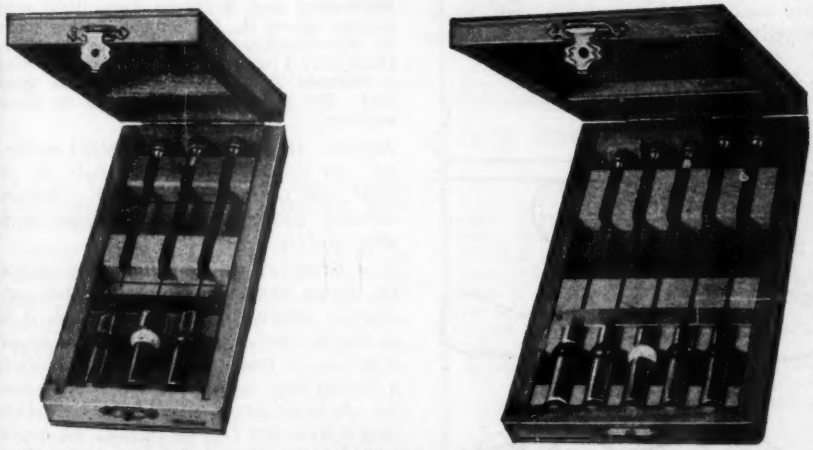
ANSWER 9. In the absence of benzine, may I suggest you try aviation gas or some of the cleaning fluids for cleaning clothes. Perhaps your local dry cleaners will let you have some or you may get some at the drug store or 10-cent stores.

Hairspring drying method

S.D.: Is it necessary to dry the hairspring in sawdust after cleaning and passing the hairspring through the rinse?

Answer: If your rinsing solution is in good condition, if you let the rinse evaporate, it will leave no ill effects. It does help to use moderate heat to quicken this operation of cleaning the hairspring. In the absence of a cleaning machine that is equipped with a heating unit, you can improvise by using an ordinary electric light bulb, with an ordinary metal shade turned upside down and a piece of thin sheet metal laid over it on which to lay the parts while drying.

BERGEON SCREWDRIVER SETS



Bergeon screwdriver sets are the finest watchmakers' screwdrivers available. All sizes are made of chrome steel with color identifying bands for easy selection. Each screwdriver has its companion tube for spare blades. Set in a handsome polished hardwood box.

Set No. 2639—Set of 5; Sizes .50 - .60 - .80 - 1.00 - 1.20 mm..... $10.25
Set No. 2631—Set of 3; Sizes .50 - .60 - .80 mm..... 7.00
Individual sizes with tube of 5 extra blades, state size, each..... 1.65

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Measuring uneven pinions

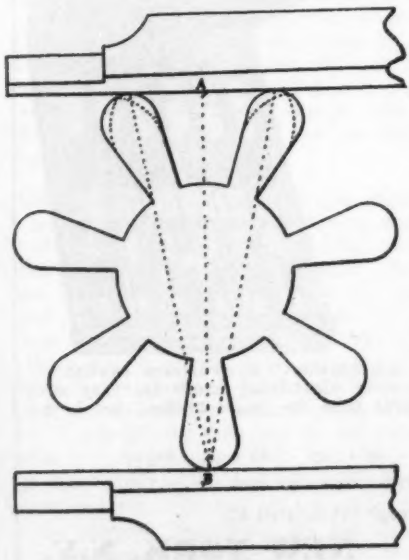
C.P.A.: Is there any way to measure the exact full diameter for a seven or nine leaf pinion? I find that drill or wire gauges are not close enough.

Answer: Watchmakers in the habit of using the one-tenth or one-twentieth millimeter slide gauge or the one-hundredth micrometer have doubtless noticed the impossibility of measuring directly the total diameter of pinions of seven and nine leaves. As a fact, in these pinions a leaf is opposite to a space and the two branches of the slide gauge touching three points of three leaves can only indicate the height of the triangle joining these points, which height is materially less than the actual diameter.

"To remedy this difficulty," says R. Viau, in La France Horlogere, "and obtain without roundabout methods, an exact measurement, I amused myself by calculating the product which multiplied by this height or distance, *AB* in the diagram, would give the total diameter of the pinion. For the sake of greater exactness, I have taken into consideration the slight difference existing between pinions with ogire-shaped rounding and those in which the rounding has the form of the arc of a circle. A glance at the sketch will suffice to show that the distance *AB* is not the same in the two cases. Here are the products:

For pinions with seven leaves—
Ogire roundings 1.0521636
Circular roundings..... 1.0441176
Thickness of leaf 20°
For pinions with nine leaves —
Ogire roundings 1.0311138
Circular roundings..... 1.0272029
Thickness of leaf 16°

"I have given seven decimals, but it will readily be understood that two or three will practically answer the purpose. According to the pinion under consideration, it will therefore suffice to multiply the distance *AB*, as given by the gauge, by one of the products given above to obtain the diameter sought."



MEASURING UNEVEN PINIONS

What about gold leaf?

C.P.W.: At one of our meetings, the subject of golf leaf was brought up for discussion and it seems very little was known about it. Of course, as we were all watchmakers, it was out of our line. However, I was delegated to drop you a request for information about gold leaf. We are looking forward to your answer.

Answer: If gold were as common as copper, tin or even silver, it would be of great use commercially for it possesses amazing properties in comparison with other metals.

It is extraordinarily ductile. Iron cannot be drawn into very thin wire because, when a certain smallness is reached, it is so fragile that it is unworkable. Copper wire can be made very little thicker than a human hair, but gold surpasses this easily. A single grain of gold can be drawn into a wire 500 feet in length; an ounce would make 48 miles, while 500 ounces would be sufficient to make a fine girdle for the earth.

Gold can be beaten out into sheets of wonderful thinness. One grain will make a sheet of gold leaf measuring seven by eight inches, with a thickness of about 1/350,000th of an inch. A pile of a million of these sheets would be no higher than an ordinary tea cup.

The latest wonder of gold working was achieved recently when gold sheets were made so thin that they were actually transparent.

Plates of copper were immersed in an electric bath and plated with gold until the yellow color was just visible. Then they were removed, and put into nitric acid which, after a few days, dissolved the copper and left a film of gold so thin that it floated upon the surface of the liquid.

These wonderful sheets were 1/2,000,000th of an inch in thickness. Ten thousand of them would have to be placed one upon another to be as thick as a single page of a newspaper.

Lacquer thinner

P.B.: I have a lot of lacquer that has become too thick to use. What chemical can I use to thin it down to its original condition?

Answer: Lacquer that has become thick through evaporation can be restored to its original consistency mixing it with a preparation called Lacquer Thinner. This can be obtained from your paint store. Aneyl-acetate or acetone can also be used as thinners. But it is better and safer to use the regular prepared lacquer thinner.

Gun-blueing formula

J.A.F.: Will you please give the formula for making gun-blueing, regular steel blueing?

Answer: There are several lacquers on the market for blueing steel such as clock hands or articles that do not have to resist wear. However, I assume that you want to color a gun or revolver where a long-wearing surface is required. The following procedure will suffice. Boil in a solution of hyposulphite of soda and acetate of lead until the desired color is obtained. All work must be chemically clean and finished to the desired surface before dipping.

Here is another way to blue gun barrels. The blueing is done by cleaning the article of all grease by dipping in boiling potash and then in five per cent solution of acetic acid (common vinegar) wipe and dry thoroughly and then rub with a linen rag moistened with hydrochloric acid. Allow

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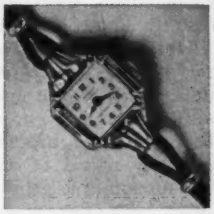

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the coating to dry for a quarter of an hour and then heat the gun barrel in a sand bath until it has acquired the desired color. If a brown color is desired, the surface is then rubbed with a cotton rag saturated with olive oil which will change the blue color to brown.

Brocot 'same difference'

G.B.A.: Will you explain the difference between a Brocot pin pallet escapement used in French clocks and the visible escapement used in American clocks?

Answer: There is no difference. They are two names for the same thing. If well made and used with a short pendulum and a heavy bob, it generally gives excellent results in mantel clocks. The best practice is to use agate or cornelian pallets and a gilded escape wheel. Cheaper clocks are made with steel pallets.

The watchmaker who does not understand this escapement is apt to get in trouble when inserting the new pallet by turning the stone in the wrong position. The flat side of each pallet would point in the direction of the center of the escape wheel; when this is done, the lifts are equal and the locks should take place on the thickest part of the pallet, so that there will be no butting friction to wear the teeth of the escape wheel.

Also, the tooth leaves the pallet clean and instantly gives the greatest freedom after the impulse has ceased. If these points are attended to, you should have no trouble with this form of escapement.

To equalize the drops, raise or lower the pallet by means of an eccentric bushing that supports the pallet arbor pivots.

Suggests repair code

B.B.: Has anyone come up with a simple code which can be scratched in the back of a watch indicating what was done and when? The continual recording and checking back in old record books seems unnecessary. Any ideas for an adequate system of recording will be appreciated.

Answer: Your writer is at a loss to refer you to any such system. Your idea sounds good and perhaps some of our readers may have some similar method and may be generous enough to let us hear from them and their system for identification.

Left hand ratchet screws

Mr. R. W. Simpson of Miami, Florida, sends in the following list of watches that have left hand ratchet wheel screws. We are all aware that left hand screws are used where there is no call for same and no doubt many of us have had the experience of trying to remove a screw that we naturally expected to be a right hand. But, to our surprise, we find it was a left hand only after the head is broken off and the screw proper left in the barrel arbor.

So, the following list is offered that may save us time and trouble. Mr. Simpson also suggested that if any models using left hand ratchet wheel screws are not listed herewith, send them to our information column, and the new number will be published. Thank you, Mr. Simpson. Here is the list of watches that have left hand thread screws in the main barrel arbor:

AS 970, 969, 1123, 1180, 1002, 964, 1023, 1051, 984, 1115
Bulova 7 AM, 5 AB, 7 AF. AL
Gruen 705

Mistaken impression

S.P.B.: I have been told that when closing a hole with a staking tool, it should be done from the lower side of the plate to prevent any visible tool marks. Do you approve of that method?

Answer: Never attempt to close the holes from the underside of the plate. That mistaken idea is seen quite often, so an explanation of the effect might be in order. The round face stake makes a saucer-like depression. When used on the lower side of the pivot hole, it has the following effects:

First, the end shake is increased. Then the flat shoulder of the pivot does not rest on a flat surface, but only contacts at its outer edge, increasing friction and more than likely the bearing surface in the hole has been made much thinner. That would have a tendency to increase the friction, and also reduce the life of the bearing. Besides, the oil would not stay in place as capillary attraction would have the tendency to draw the oil away from the pivot rather than to retain the oil at the shoulder of the pivots.

Elgin's 1st millionth watch

K.G.: Can you tell us how many years it took the Elgin National Watch Company to produce the first million watches?

Answer: Their first 100 watches were made in 1867, and it was not until 1882 that they reached the million mark.

Poise balance with roller

C.W.W.: Should the balance be stripped of the roller to poise it?

Answer: Do not remove the roller before poising a balance. Instead, regard the balance and roller as a unit as they rightly are when brought together and when in action in the watch. Remove the hairspring, examine the pivots very carefully with a strong loupe to make sure that they are not bent or rough or burred on the ends, for a very slight bend or any burrs on the pivots is enough to upset the results of the most careful poising.

It is also wise to make certain the balance is perfectly true in round and flat. See that the roller jewel is upright and firmly in place. Remove any surplus shellac on the roller jewel, using a small brass scraper to prevent injury to the jewel. See that the roller is true in flat, and that the safety roller is true in the round, as we often find that such conditions exist in many watches that have fallen into inexperienced hands. And after you have taken care of these conditions and made proper corrections, you can then, with confidence, go ahead and poise the balance wheel and expect proper results.

Willard banjo clock

C.L.H.: I have a Willard Banjo Clock that has an eagle ornament. Can you tell its value and about how old it is?

Answer: This column cannot estimate any values on antique clocks or watches. Corresponding with Mr. E. T. Strickler, 335 N. Third Street, Columbia, Pennsylvania, secretary of the National Association of Watch and Clock Collectors, Inc., may be advantageous to you. From reference books, we learn as follows: It will depend entirely on the condition and work-

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manship—also upon which Willard made your clock.

They are:	Aaron,	1757-1814
	Aaron, Jr.,	1823-1863
	Alexander T.,	1800-1840
	Philander I.,	1825-1840
	Simon, Jr.,	1795-1874
	Zabdiel A.,	1841-1870

The greatest of these was Simon. The others have all shone from the reflected glory of the founder of the family and the inventor of the design which is now popularly known as the Banjo Clock. The original Willard cases had an acorn top. If yours has an eagle, it was of later design and introduced by Samuel Whiting and afterwards adopted by the other Willards.

Mainspring discrepancies

E.W.M.: Who sets the correct mainspring sizes for the different watch models? There seems to be a wide discrepancy between material books and mainspring manufacturers. I realize that each book you consult is published by a company with their own mainspring system, but it seems to me there should be some common rule as to what size mainspring should fit what model watch. The various material books and mainspring manufacturers seem to make up their own rules and sizes.

As a specific example: Recently I was in need of a mainspring for a model CA Benrus. I consulted three material catalogs and found I needed a 6-13-9½. My mainspring cabinet told me the correct size was 5-13-9½ and identified the CA Benrus on the envelope of a 5-13-9½ and in addition, told me this 5-13-9½ would also fit an AS 1051, B N Benrus, Eta 1241 and Kurth 257. I took this list and looked the four models up in my three material books, and came up with these widely separated figures, ranging from 5-12-10 to 7-13-9½.

Now, who is to be the final judge on the correct size? My books tell me all kinds of stories, and the manufacturers say something else again. If I wanted a 7-13-9½ (book figure) for model 257, I'd end up with a 5-13-9½ from the material house—a difference of 1.60 to 1.40. What's the answer? One more thing—after we decide who it is that has the final say on the correct size, how much can we vary, if any, from that size and still service our watches correctly?

I've been with the A.H.&J. since 1949 and find it a very handy source of information. I'll be around for a good many years.

Answer: You are not alone in the confusion of seeking a proper mainspring from our different material catalogs to fit some particular watch. Just where to put the blame is a question, as each one that compiled these lists was sincere and spent a lot of time making up what they thought to be a perfect and reliable list of strength and width as well as the correct length for all mainsprings.

It is quite possible that when gauging the mainsprings, the measuring instruments were not in good condition, and the readings did not agree with the instruments used by others making up a mainspring list. Thus, we could have two or three different sized mainsprings listed for the same model watch.

It could also be that at the time the factory assembled the watch, it did now show enough balance arc, requiring a little stronger spring, and perhaps one of these watches fell into the hands of the material house and this spring was accepted for standard and listed accordingly.

Perhaps a printer's error might account for some mix-ups, and then a misreading of the micrometer might enter the picture. We don't always agree on the micrometer, as some have a heavy touch and others a light touch when gauging with the micrometer. Thus we often find discrepancies of ¼ to ½ thousandth of an inch.

The object when replacing a mainspring is to obtain a balance arc of 1¼ to 1½ turns so that the watch will run approximately 36 hours. So if we get a mainspring that does not perform properly, we must, from experience and judgment, select a mainspring that will be suitable. Summing up all our hazards, I am inclined to rely on

Models Listed on mnspg. env.	1954-55 material book	1952 material book	1946 material book
AS 1051	6-13-9½	6-13-9½	5-13-9
Benrus B N	5-13-9½	5-12-10	Not Listed
Eta 1241	5-13-9½	5-12-10	Not Listed
Kurth 257	7-13-9½	7-13-9½	7-13-9½

the manufacturer's list of mainsprings as standard. At present, a new book is being compiled by Mr. Henry Fried, an experienced watchmaker and author, and it will give a complete list of all Swiss materials for all Swiss watches on the market. We are looking forward to this most wanted Standard Material Catalog.

Stem pulls out

KC: I am troubled with a watch that has been returned several times on account of the stem pulling out. I have fitted a new stem and everything seems to be in order, but still the watch is brought back with the same complaint. Can you offer any suggestions? What can I do to satisfy my customer?

Answer: This question has arisen before. You will find the fault to be in the detent lever or the detent lever screw, or both. Check to see if the shoulder of the thread just protrudes a fraction above the plate. When the screw is tightened, the underside of the detent lever must have two to three hundredths of a millimeter for clearance or freedom.

Fastening a pearl to pin

W.A.W.: I have a job that entails fastening a pearl to the end of a stickpin. There is a hole in the pearl. What I am concerned about is this: Is the end of the pin supposed to be threaded so as to screw into the pearl?

Answer: The pin is not supposed to be threaded into the pearl. Instead, it is cemented fast. First, roughen up the end of the pin that is inserted into the pearl. It could be cross-filed or nicked with a sharp tool. Then fill the hole in the pearl with shredded shellac, heat the end of the pin quite hot and force it into the shellac. The shellac will melt and adhere to the pearl. When cool, scrape away the surplus shellac, being very careful not to injure the surface of the pearl.

Value of Tobias watch

C.B.B.: What can I tell a customer who owns a M. I. Tobias and Company of Liverpool, that has a cylinder escapement and four jewels, how old this watch is, and its value?

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Green .055"
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Blade sizes .030", .035", .041"
Price $1.55

Set of 3 — CODE ABJS
Blade sizes .055", .070", .094"
Price $2.25

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Blade sizes .016", .020", .026" .030", .035", .041" .055", .070", .094"
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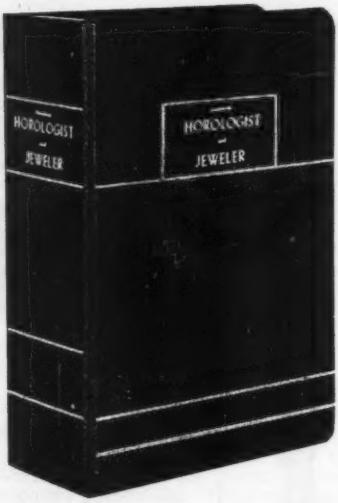

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Answer: The watch you described was made in Switzerland for Tobias and Company for export to America, approximately 1840-1860. There were many thousands of these watches sold in the U. S. and there are so many in existence today that they have no value more than the metal in their case. However, in time they will be considered a collector's item. In fact, you may get a little more than the old metal value as long as the watch remains intact. There are always new collectors that are glad to pick up a M. I. Tobias and Company.

Indian jewelry symbol

AK: Recently I had occasion to repair a silver bracelet set with turquoise, and on a plain part of the bracelet was engraved two arrows, parallel, but pointing in opposite directions. The bracelet was made by an Indian and I am curious to learn if the arrows had any meaning.

Answer: According to Indian symbols and their meaning, passing arrows means mutual friendship.

Selecting proper roller

PM: How can I determine proper size of roller table for a watch that is not catalogued?

Answer: Assuming that the rest of the escapement is in proper adjustment, the correct diameter for roller must be selected from an assortment of sizes until one is found that will allow the correct amount of shake between guard pin and roller edge and the correct passage of roller jewel through fork slot; corner freedom of roller jewel and corner of slot during unlocking and impulse. You may have to change position of roller jewel to obtain the latter condition.

Cutting plier service

V.A.R.: We read on page 26 of the American Horologist and Jeweler magazine for the month of October, 1955, that you do not know of anyone who puts cutting pliers in working condition. We happen to know of one man who does this type of work, as we have had a few cutting pliers done. He does a wonderful job very reasonably. His name and address is: A. F. Ovellet, 215 West 12th Street, New York 11, N. Y.

Robert F. Houghton looks over one of the old Waterbury clocks he sold 50 years ago and the new Timex electric clocks he is now helping to market.

50 Years A Time Salesman

FIFTY years is a long time to spend with one company, but if Robert F. Houghton of 60 Locust Street, Floral Park, Long Island, had it to do over again, he'd pick the same career that brought him from office boy to assistant to the sales director of the United States Time Corporation, the world's largest manufacturer of watches.

Houghton's half-century of peddling Waterbury, Ingersoll and Timex products from Maine to the Gulf Coast states embraced three national depressions and changes in business as drastic as those in transportation, which went from the horse cars he first rode to the airplanes he uses today.

Friend, sponsor and boss for better than half of his business career was William H. B. DuMont, father of Allen R. DuMont of television and electronics fame. It was DuMont who gave Houghton his first chance in the sales field.

"He was one of the finest men I ever knew," Houghton says. "When I was office boy, back in 1905, my two main jobs were to pick up the weekly check for delivery of watches from Waterbury to the Ingersoll Company, and to run the letter press. In those days, we copied letters—and they were practically all hand-written—by pressing a wet blotter and tissue paper on top of the letter. When it got hot during the summer and the blotters began to stick, Mr. DuMont would hand me five dollars and say, "Here, go pick up the boys and take them out to Manhattan Beach for the afternoon!"

The three DuMont boys hated to see Bob Houghton go on the road in 1907; and his mother was so afraid he'd lose the $400 advance for eight weeks' expenses that she made him a money belt.

"Those were the days," Houghton reminisces, "when the stores opened at seven a.m. and watchmakers not only swept out the jewelry stores, they cleaned the street, too. Sometimes the trains and trolley cars didn't connect and you picked up your baggage and sample cases and walked to the place where they did. If it was snowing or freezing cold, you walked faster."

During that 1907 trip through northern and western New York, Houghton sometimes had to fight his way through angry mobs gathered in front of banks demanding their money back. "It was worse in cities than in the towns," he says.

By the time he entered the Army in World War I, the wrist watch had replaced the Ingersoll, "the watch that made the dollar famous," in popularity. This was not surprising because Ingersoll, biggest advertiser, promoter and salesman of his day, was the first to sell a wrist watch and corner the market.

"When I got out of the service," Houghton relates, "Ingersoll was in trouble. The demand for wrist watches had been so enormous that he took over the distribution himself. When the demand slacked off and the depression moved in on us, Ingersoll had a hard time trying to win back the support of the wholesalers. That was his biggest mistake."

Robert Ingersoll who had bought and sold the entire output of the Waterbury Clock Company for nearly 30 years went bankrupt. Waterbury bought the assets.

"I remember that well," Houghton said. "Mr. DuMont called me in and reminded me that I'd seen some pretty big checks when I was an office boy. Then he showed me the check that purchased the Ingersoll Company. It read *fifteen hundred thousand dollars*. I looked at it twice before the amount really sank in, and he was right, it *was* the biggest check I'd ever seen!"

Necessity sparks idea

Adversity produces ingenuity and inventiveness, Houghton believes. Mickey Mouse is a case in point.

"We'd gone through three tough years in the early thirties," Houghton explains. "Things had gone from bad to worse to terrible. So, when they called us salesmen in during 1933 and showed us the new Mickey Mouse watch we were to sell, we couldn't help but think that now everyone had gone crazy.

"Seven of us started out with a two-week exclusive sale plan for department stores. I went through Pennsylvania, Ohio and into Kentucky before I was told to work my way back to New York. I had one order.

"The other six didn't do any better, and we all agreed that the best merchandisers in the country thought that we were just plain nuts. It really looked as though Mickey Mouse was doomed to go back to his hole in the wall.

"Then Macy's came out with a big Mickey Mouse promotion. That did it," Houghton says. "Orders began pouring in from all over the country—some from buyers who'd turned us down only days before."

Mickey Mouse makes grade

Bob Houghton admits that he didn't think Mickey Mouse would make the grade. "Times were tough and I wasn't convinced until I got to Philadelphia. They sent me a Mickey Mouse display with flashing lights. Twelve watches went with each display. When I sold 969 of those displays the first day, I knew for sure that Mickey Mouse would be around for a long, long time. Funny how you can plug along for 28 years and then a little mouse comes along and catches the public's fancy and you sell 11,628 watches in a single day!"

Cinderella and Davy Crockett have done the same thing in recent years; but Bob Houghton's greatest pride is the part he played in World War II.

Called to Waterbury as a production expediter, he helped U. S. Time turn its entire output into fuses, gyroscopes and timing devices for bombs, shells, and almost every conceivable instrument of war. He saw the old hillside factory where one walked from the fifth floor of one building into the third floor of another replaced by the most modern plant of its kind in the world in nearby Middlebury, and when the war had been won, he had the satisfaction of knowing that he had helped produce nearly $180,000,000 worth of vital precision war instruments—the greatest volume of any company in the industry.

After the war, Houghton helped plan the sales program for new plants in Toronto and Dundee, Scotland, as well as in Abilene, Texas, and Little Rock, Arkansas.

"I never dreamed, back in 1905," he says, "that the day would come when I'd be selling watches and clocks made in our plants in Abilene and Little Rock. Why, in those days, Buffalo and Syracuse seemed as far away as those cities do today."

Houghton was honored by the entire national sales organization of Timex at the Hotel Warwick, New York City, last December 5.

How About a Report Card for Your Jewelry Store?

By DAN VALENTINE

The only way parents can know whether their children are doing all right in school is to look at the monthly report cards made out by the teacher.

It's the same way with a jewelry store.

Every jewelry store should have a monthly checkover by the owner to catch the little things that have to be done, to correct the little errors being made.

There are a hundred and one little details that make for a successful retail jewelry store. Some of these details are so small and so seemingly unimportant that many a jewelry store proprietor passes over them as inconsequential.

Nevertheless, it's the little things that make or break a retail jewelry business, and if you let one thing go, then another, it won't be long before your store takes on a jaded look. And remember, customers like to do business at a store that looks spic and span, on the ball, fresh and inviting.

Cobwebs anywhere ( ).
Walls need washing ( ).
Cracks need filling ( ).
Light switches work ( ).
Floor need waxing ( ).
Venetian blinds clean ( ).
All mirrors shiny ( ).
Pictures straight, clean ( ).
Clock tells right time ( ).
Chairs need repair ( ).
Tables all okay ( ).
Under-counter shelves neat ( ).
Cash register clean ( ).

By using the above monthly report card, you'll find that your store will be kept up to date. It won't and can't slip—if you check it each and every 30 days.

And remember, it's far easier to keep your shop up to date and in full repair than it is to let it slip and slip until it takes a major operation to bring it back to par again.

So check your store monthly with a "report card." It will pay off!

Paste up the following monthly report card in your back room—and go down the list, item by item, every 30 days, correcting faults, making minor repairs. The result will be a better-looking, more-inviting establishment.

JEWELRY STORE REPORT CARD

SIDEWALK:

Does walk need washing ( ).
Any cracks to fill ( ).
Any debris in curb gutter ( ).
Is front mat worn ( ).

OUTSIDE SHOP:

Is sign working okay ( ).
Does it need washing ( ).
Front windows clean ( ).
Front door open easily ( ).
Check sign supports ( ).
Any faded signs in window ( ).
Holes in screen door ( ).

INSIDE SHOP:

Air conditioning work ( ).
Any blown-out bulbs ( ).
Windows clean ( ).

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80 Cranberry St. Brooklyn 1, New York also Telephone MAin 4-3900, Extension

CLOCKWISE and Otherwise

By J. E. COLEMAN

Mr. Coleman invites your questions. If your question requires a direct answer, please enclose a self-addressed, stamped envelope. It is impossible through correspondence to give valuations of antique time-pieces; questions of this nature cannot be answered accurately.

Comment and Criticism Show Serious Reading

TO START OFF 1956, we were considering whether or not to make of the first "Otherwise" a sort of a review—and then along came the following good letter from Captain G. T. McCready of Monterey, California:

Dear Mr. Coleman:

First of all, I must thank you for your most informative and interesting column, Clockwise and Otherwise. I have enjoyed it and profited by it very much.

I am somewhat of a new addict—clocks and horology are a hobby with me. Only recently, through the kindness of one of my associates, Professor G. R. Giet, I have been privileged to browse through his five years' issues of A.H.&J. Result is that I am a new subscriber, and with many others, turn first to C. & O.

As you may expect, I have a few questions and comments for you. There is no hurry in these, and possibly having little or no interest for other subscribers, they do not deserve appearing in the journal. Accordingly, I am submitting them in the enclosures. Please scribble your response, if any, on the copies of them and return to me.

Again, please accept my thanks for the pleasure and learning you give to so many.

G. T. McCREADY

Box 685
U. S. Naval Postgraduate School
Monterey, California

We appreciate what the Captain has to say about the column very much, but differ with him as to his comments and questions deserving a spot in the column. The comments show serious study, and the questions are to the point. My over-all thought is—the bench horologist should "sit up and take notice." Perhaps your very next repair customer may be a serious student of horology.

Comment 1. The article on Hardy's clock (A.H.&J., January, 1952, pg. 38) contains no reference as to the gear ratios or dimensions as used by him. Only one dimension is given and that is on the mercury glass. My count of the wheel teeth gives as the train:

$$\frac{180}{82} \quad \frac{76}{14} \quad \frac{140}{16} \quad \frac{60}{16}$$

Obviously, this is either an error, or a draftsman's choice for ease and simplicity. Presuming that this clock is somewhat of a regulator, and that in those days, they favored high number gears, it might have been:

$$\frac{180}{60} \quad \frac{120}{15} \quad \frac{135}{18} \quad \frac{96}{12}$$

or

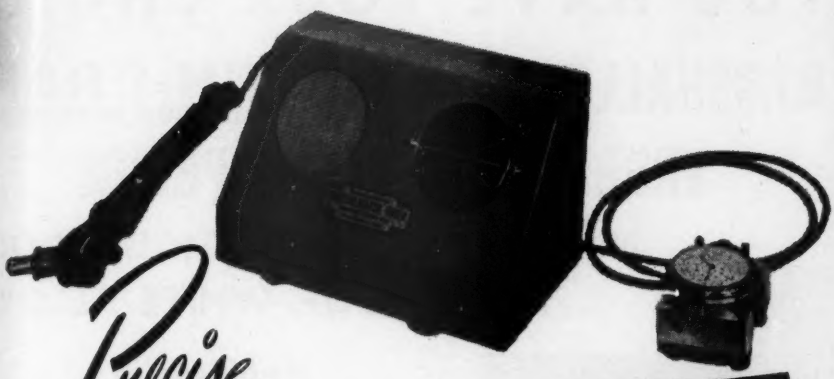
$$\frac{180}{60} \quad \frac{112}{14} \quad \frac{120}{16} \quad \frac{120}{15}$$

or

$$\frac{180}{60} \quad \frac{120}{15} \quad \frac{120}{16} \quad \frac{128}{16}$$

or =

$$\frac{8}{1} \quad \frac{3}{1} \quad \frac{8}{1} \quad \frac{7\frac{1}{2}}{1}$$



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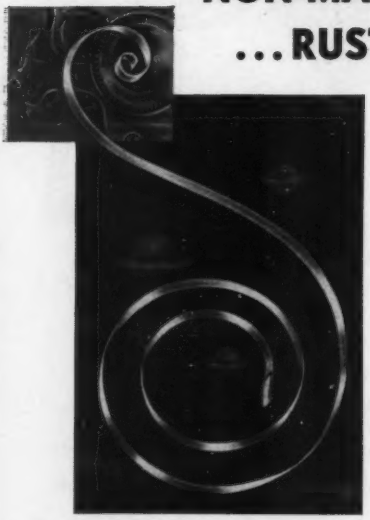

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Question 1. Do you have any information on the train gear ratios for Hardy's clock?

I have no further data on the Hardy clock; could easily go along with you on the "draftsman's choice." Mr. Paul Blanchat of 316 All Hallows Road, Wichita 12, Kansas, has one of these clocks in his collection. I am sure he would be pleased to count its train, and answer any other questions you may have relative to it, if you will write him at that address.

Comment 2. Has anyone ever recorded that there is a typographical error in Milham's Time and Timekeepers? (The reprint of April, 1947, page 269.) Should not the first of the four pinions in the train count be 12 teeth?

Question 2. Refer to A.H.&J., October, 1952, page 21. What is the origin of the table pertaining to mainspring calculations?

We do not have a copy of the 1947 reprint, but feel sure that the figures are the same as the first (1923) edition. Further, Professor Milham's figures are correct. If you will turn over the page (270) and have a look at the skeleton cut of the chronometer, you will see that the first pinion you are concerned about is on the center post, and that it does not enter into the type calculation you have in mind. First edition says 14 leaves; you suggest 12 leaves. It could also be 8 or 16, and not alter the calculation referred to above. Let's note the Professor's figures: "The four wheels in order usually have 90, 90, 80 and 80 teeth, and the four pinions 12, 12, 10 and 10 leaves." The first 90 teeth are for the fusee wheel (main-wheel) and the first pinion of 14 is on the center (hour) post. This ratio has to do with the number of hours the mainspring will drive the chronometer and *not* the rate at which it is driven.

Now (again the Professor's figures) the center wheel of 90 teeth will turn the third wheel with 12-leaf pinion seven and one-half times. The third wheel of eighty teeth will turn the fourth wheel with 10-leaf pinion eight times. Seven and one-half times eight equals 60, the correct ratio between center post (hour hand) and fourth arbor (second hand).

As to your second question, we suspect it would not be far amiss to say that the real origin of mainspring calculation is a bit indefinite. No doubt there have been alterations from time to time despite the fact that the basic principal of power application in this manner remains virtually the same. The Journal Suisse d'Horlogerie Nos. 7 and 8 for July and August, 1955, has a lengthy article beginning on page 291, by G. A. Berner, in this connection, and it is one of the best we've ever seen.

Question 3. Refer to November, 1955, issue, page 37. Is it possible to get more complete data on Lang's torsion pendulum clock?

I'm sure it is—in fact, I'd like it myself. Write to Oscar T. Lang, 802 Wesley Temple Bldg., Minneapolis 3, Minnesota, and tack a postscript to your letter suggesting that he make an extra carbon for C. & O. files. Mr. Lang is a collector and a serious student of horological construction. In my estimation, he is also one of the best draftsmen in the country. I'll bet we never find him exercising a "draftsman's choice" when putting a clock to paper.

Question 4. Refer to November, 1951, and to March, 1952. Is there any later word on the regulator kit to be put out by the firm of Beehler and Black Co. of Chebeague Island, Maine?

Yes; they later got into production. Whether now producing or not, I don't know. In case you happen to wish one of their kits, I feel sure they could supply it. Write Howard Beehler, c/o Beehler & Black, Chebeague Island, Maine.

Question 5. Refer to December, 1952, page 56. Has Mr. Platow followed up with his data on the Oslo Town Hall clock?

Only in part. I quote here from his last letter: "Later I must compile an exact description with illustrations of the astronomical clock, the great tower clock 28 feet in diameter, the separate striking part and the carillon, but it will take some time to arrange this and write it. I hope we can secure a little folder with the dial in color. In due time, I can report to you on the matter.

"P.S.—The clocks are weight-driven, the carillon electrical. The astrolab gets an impulse every minute from the master clock. The great clock has a second pendulum and can be synchronized with the master clock by means of a patented invention of mine. However, it can go independently."

Comment 3. I know that you must have an extensive library of horological information, and I thought you might like a note from a source a bit far from this. I refer to the fact that extensive "how to build it yourself" information on the Shortt Precision Clock is contained in Amateur Telescope Making (Advanced) by A. G. Ingalls, associate editor of Scientific American. The Scientific American for July, 1951, also had an article about this clock and its replicas built by amateurs. You might also like to know that the Synchronome Company will sell the knock-down parts, partially finished, to anyone for a very moderate price. In 1951, the quoted price, including shipping to New York City, but not including import duties, was about $75.00. Their address is Synchronome Company, Alperton, Wembly, Middlesex.

Yes, we have this information. There is a story to the effect that Mr. Frank Hope-Jones, inventor of this clock (1895) and author of the book, "Electrical Timekeeping" (A.H.&J. Book Dept. No. B-208, $6.00) made provisions for the amateur mechanic and/or horologist to always be able to secure permission and parts for building one of his free pendulum regulators.

Comment 4. It is unfortunate that Kelly's article in the November, 1955, issue is marred by some errors. An article of this kind is very useful, I would imagine, and on being studied by the younger newcomer, these errors will be readily evident. The inaccuracy which I show herewith, however, is most unfortunate. It so happens I have been seeking accurate information on the escapement and have been unable to find it in the usual readily available works. This article and others to which I refer have a degree of carelessness which is misleading. I can easily accept computations that do not go out to useless ten decimals, but those that slur

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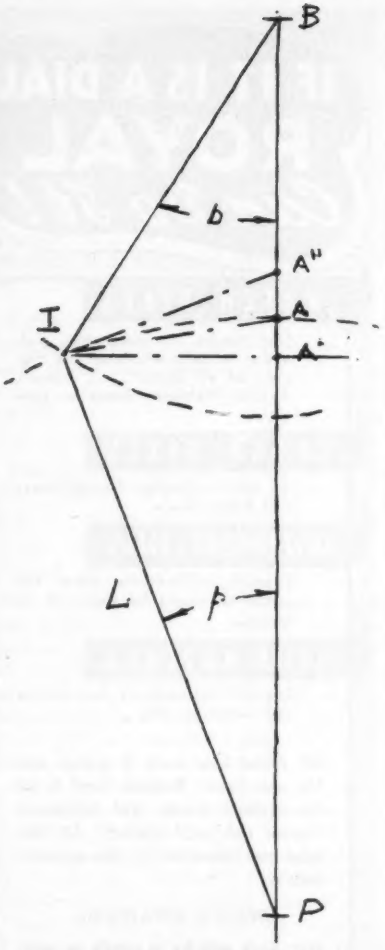

over geometric facts are harmful.

Knowing that you have a Saunier, could you let me know if I will find accurate dimensional data on the escapement?

This sketch corresponds to Figures 10, 11 and 12. It is here distorted so as to clearly show geometric relations.

IA is not perpendicular to either PB or IP and the right triangle technique is improper. IA' is perpendicular to PB and this IA'P is a right triangle.

We then can proceed:

Given: b = 17½° Find: PB
p = 5° IB
L = 1

PA' = cos P x L = .9962 x 1 = .9962
IA' = sin P x L = .0872 x 1 = .0872

$$BI = \frac{IA'}{\sin b} = \frac{.0872}{.3007} = .290$$

$$BA' = \frac{IA'}{\tan b} = \frac{.0872}{.3153} = .2775$$

PB = PA' + A'B = .9962 + 2775 = 1.2737
(Above are my slide rule values)

You will note that the 1.2737 is close to his 1.272. However, his formula where he finds sum of sines of two angles as sine of sum of two angles is not geometrically permitted.

The question first. Yes, I believe that you will find what you want in Saunier. Our book department stocks the Saunier reprint, No. B-281, 844 pages, many illustrations with tables and drawings in colors, $12.50.

Typographical errors have beset the horologist since the earliest days. Antoine Thiout (1692-1767), watchmaker to the Duke of Orleans, published his famous treatise "d'Horlogerie" in two large volumes in 1741. Louis Moinet (1758-1853), an eminent horologist who had worked with Breguet and published a treatise of his own, when referring to Thiout's work remarked: "It is without doubt very badly composed, and the printing is still worse; errors of orthography and punctuation often occasion contradictions but, nevertheless, readers with a knowledge of the subject may still find useful ideas in it, and some sound advice."

Frankly, I'm going to dodge further mention of the type errors, for the simple reason that I make many of them myself, and I don't want to get in dutch with G.H.Q. at Denver. Truth of the matter is, perhaps I'm already in the "dog house" for I mentioned that 14-inch watch barrel (page 56, November issue) and haven't heard about it yet.

Mr. Harold Kelly is a fellow Californian of yours and one of the finest fellows you would ever meet. I'm not familiar with your state, but Monterey can't be too far from Monrovia. So, if you are ever down that way, drop in at No. 263 May Avenue and see him. All of us welcome comment and even criticism; it shows that we are being seriously read. Thank you for your co-operation.

* * *

Letters and cards about average this month. Highlight of the month was a visit by Dr. Arthur L. Rawlings. Despite the fact we prevailed on him to spend the night with us, and the horological chat went well beyond several cups of tea, and far into the wee hours, the time seemed all too short.

Among other things, we discussed the translation of volume two of Grossman's Lessons in Horology. The first volume was translated by Mr. James Allan, Jr., about 1905, but to date the second volume of this great work still remains in the original French. Many watchmakers' libraries contain the first translation, just awaiting its companion. The big question—how many?

* * *

Quite a number of inquiries wanting the address of Mr. Robert L. Rod. It is c/o Acoustica Associates, Inc., Shore Road, Glenwood Landing, Long Island, New York. We are quite aware of the column's promise of further data on ultrasonic aid to cleaning, and other uses of ultrasonics for the bench horologist, but we are going to have to plead for a little more time. Seems we really caught this one early.

Since mentioning it, we've had a number of letters, among them one from France, England and Switzerland, and a couple of long-distance calls. Via the "grape-vine" we have the information that at least two of our major material dealers are seriously looking into it with a view

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of handling the machine for the horological trade. Since the column first mentioned it, ultrasonics has hit public advertising. Did you see the Enicar watch advertisement in Life magazine a couple of weeks back that stressed it? We've had some correspondence with them. Their use of ultrasonics is strictly a factory production set-up, however. The following is a quote from one letter: "For the time being, the complete ultrasonic installation is not available on the market. A few firms only who contributed to the realization of this new process are entitled to buy such installations. Yet we assume that in the course of the next year, small sets intended for jewelers and watchmakers will appear on the market."

From that statement, I take it that there is no question in the minds of Enicar's technicians about the process being adaptable to the repairman's bench. Mr. Rod has made a faithful promise that he will airmail us full data just as soon as it is possible to release it. You may still look to your C. & O. for the very latest for the repair bench.

Jan and I appreciate very much the many Christmas cards and letters, and take this opportunity to say a "thank you" to all.

J. & J.

Banjo clock information

Dear Mr. Coleman:

Can you furnish me with any information on banjo clocks (possibly other types) bearing a name on the dial of Biglo Canard or Biglo Kanard or a name very similar?

If possible, I would like to know approximate time and place of manufacture, popularity and any other information available.

H. J. SCHITTERER
831 Nineteenth Street
San Diego 2, California

Dear Mr. Schitterer:

It was first "Bigelow & Bros.," beginning about 1842. Later, it became "Bigelow & Kennard," and is now "Bigelow, Kennard Co., Inc.," 384 Boyle Street, Boston, Massachusetts.

Prior to World War I, Germany was exporting some very fine banjo clocks. A number of leading jewelry stores in the United States like Bigelow, Kennard Co. brought them in and had their own name placed on the dial. You will probably find the back plate of this clock carries a German trademark.

We had one, a couple of months back, of better than usual construction. It had eighty-beat pendulum, fine banjo case, with Bailey, Banks & Biddle on the dial (Philadelphia jewelers) and was constructed to

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run 12 months with only one winding. You might direct a letter to the above firm at 384 Boyle Street, and give them detailed description of both the movement and the case. Possibly they will tell you the maker and approximate date of importation. Hope that you have better luck than I did —no reply to my similar query.

J. E. C.

Atmos principle

Dear Mr. Coleman:

Please accept the thanks and appreciation of a regular reader of your column. It is most helpful.

I have two questions that I would like to ask you. First, what is the principle on which the new Atmos so-called "perpetual motion clock" works? According to the sales literature, the change of room temperature provides the driving energy, but in a modern house where temperatures are thermostatically maintained at nearly a constant point, it seems difficult to believe that sufficient energy would be generated. Do you have any special advice on the repair of these clocks?

Second, what is the objection to using ordinary white gasoline for cleaning clocks where the movement is not exposed to view? If the movement is taken apart, scrubbed in gasoline, pivot-holes pegged out, pivots polished, and all parts dried in an oven, I cannot see any reason why brass and steel parts must be shined when they are never exposed to view. However, if you think the soap and ammonia formulas are essential, what rinse do you recommend? Thanks again for the good work in your column.

JAMES L. TIGNER

Box 88
Rensselaerville, New York

Dear Mr. Tigner:

If you've examined the Atmos closely, you discovered a double ratchet-click, and that the teeth of the ratchet are pretty fine. Now, with two clicks (they are not synchronized) it is possible for this clock to wind by just one half ratchet tooth. The normal minimum running reservoir of spring power in the Atmos clock is one year. Put these two facts together and you

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can readily see that temperature variations can easily keep it running.

Regarding repairing: A. H. & J. published as lead article in the June, 1952 issue, "How to Repair Atmos—The Perpetual Motion Clock." Vacheron & Constantin, Le Coultre Watches, Inc., 580 Fifth Avenue, New York 19, New York publishes a little booklet for watch and clockmakers, "How to Repair Atmos."

White gasoline leaves a thin film on anything cleaned in it. This film does two things—it has a tendency to contaminate the fresh oil you apply and it has a tendency to make the oil crawl or creep away from the pivots. It does not matter whether the parts are exposed to view or not, the prime object of having steel and brass parts "shine" is that it indicates to the repairman that the piece is thoroughly clean, that there is no remaining parrafin or chemical to contaminate your lubricant.

Soap and ammonia formula do this much better than white gasoline, naphtha, etc. From these cleaners, the work should be quickly rinsed under hot running water, then in alcohol and dried in warm boxwood sawdust. J. E. C.

Dissolving gummed oil

Dear Mr. Coleman:

I would appreciate it very much if you would give me a formula for making a cleaning solution that will dissolve gummed-up oil on clocks—especially electric clocks.

I seem to have difficulty in cleaning clocks thoroughly. There always seems to be old grease left in the pivot holes.

JACK IKAWA

344 C Street
Fresno, California

Dear Mr. Ikawa:

One of the best clock cleaning solutions is made of one ounce oleic acid, two ounces acetone, four ounces stronger ammonia, eight ounces water. You may double or quadruple this to obtain the desired amount. Distilled water is best, but by experience, we've found that water boiled vigorously and allowed to stand overnight works just as well. Pour off the top next morning just what you need without stirring it.

This solution should be kept in a container with good fitting top—enamel or

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pyrex—so that it does not touch metal. It naturally works better if heated (never allow it to come to a boil). All parts should be rinsed as quickly as possible after being removed from the solution, as the ammonia will oxidize them if allowed to dry.

No solution will reach the very tough ones in a short time. Some of the electrics seem to have used a type of grease which age virtually turns into a varnish. It is well to peg out all pivot holes and with any clock that indicates a varnish state, allow those parts to soak a little while.

J. E. C.

How to set up a sundial?

Dear Mr. Coleman:

The enclosed clipping was taken from the Bridgeport Sunday Post, November 13. Although not meant to aid anyone to build or set up a sundial, you may be interested in the personalities involved, or as an item for your files.

My interest lies with watch repairing, but I've read your column on clocks for many years now—since 1947, to be more precise. It has occurred to me, since reading the clipping, that I'm a man who repairs watches but cannot set up a sundial. Someday, I will be greatly embarrassed if some friend asks me to set up a sundial and I'm forced to admit I am ignorant of this basic timekeeper.

Can you, therefore, give the necessary information in your column that will enable me to properly place a sundial? Also, if it is not asking too much, supply a few lines of the mechanics of the thing. I'm toying with the idea of building a sundial myself.

EDWARD B. CASPER

Blueberry Lane
Monroe, Connecticut

Dear Mr. Casper:

First, I want to thank you for a most interesting clipping. It certainly goes into the files because the address of this outstanding dial builder is contained therein.

The information necessary to set up a sundial would depend wholly on type of dial. For example, about 99% of all horizontal dials (surface flat and level) have the gnomon pointing directly to the North

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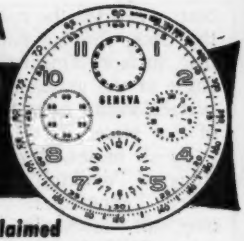

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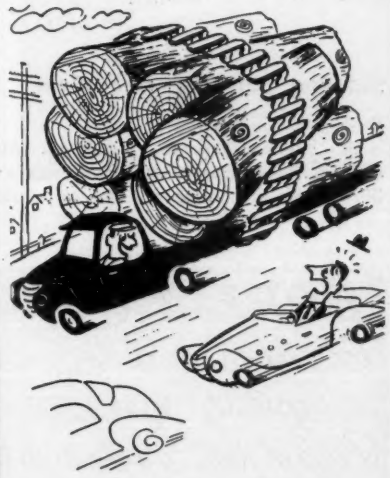

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Star. Provided the dial was first built for that spot, you can readily see that if the dial surface remains flat and level, the angle of the gnomon as it related to that surface would have to equal the latitude of that place.

By all means, devote some time to the study of "dialing," or as it is sometimes called, "gnomonics." It includes astronomy, art, mechanics, mathematics, architecture and geometry, and is most interesting. You probably have (or can get it at your local library) a copy of Dr. Willis I. Milham's "Time and Timekeepers." Chapter two is devoted to the sundial. In the back of that volume is listed some 15 books that have been written on dialing. F. J. Britten's "Watch and Clockmaker's Handbook" has a short article. Both Milham and Britten give instructions for making a correct horizontal dial.

You can readily see that the mere fundamentals of dialing alone would fill several issues of a publication the size of A.H.&J. Many practicing watchmakers fail to recognize the sundial as a scientific instrument. It is—just as much as a watch or clock. The column would appreciate a nice, long letter telling of your study and including a photo of the dial you build. On the whole, bench mechanics ought to know more about sundials.

J. E. C.

Slowing calendar pendulum

Dear Mr. Coleman:

My question regarding an Ithaca clock is about the length of the pendulum. When this job came in, the suspension spring on the end of the pendulum rod was broken and the bob had been lost. I put a new spring on the rod and used an old bob I had. The clock gained one hour in 24. I then changed to a much stiffer spring and heavier bob, and it now gains about 18 minutes a day. The bob is set about as low as it can be without hitting the bottom of the case. The length of the suspension spring is fixed within fairly close limits by the offset in the rod to clear the calendar dial. I don't know what else I can do to slow the thing up. Can you suggest anything?

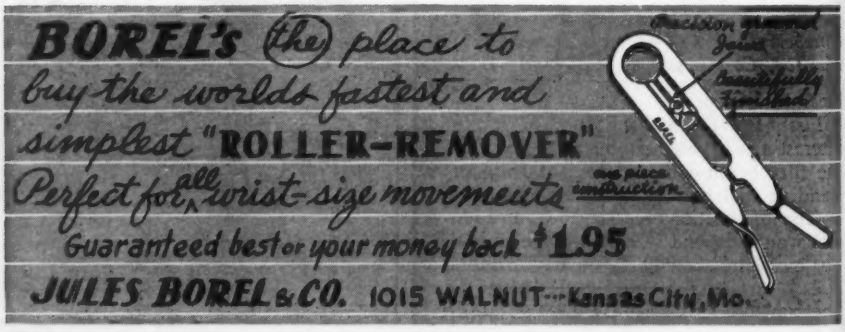
A. T. STONEHOUSE
529 University Avenue
San Diego 3, California

Dear Mr. Stonehouse:

Basically, and within reasonable limits, neither the strength of the pendulum suspension spring nor the gross weight of the pendulum ball alters very much the timekeeping of your clock. The one controlling factor is the length of the pendulum.

You may take the common "garden" variety of eight-day mantel clock and either double the strength of the suspension spring or cut it in half (don't alter the length of the pendulum) and you will be greatly surprised to find that the timekeeping at the end of the week had been changed very, very little. On the other hand, you may add to the weight of the ball or take from it (at the center of gravity, so as not to alter the effective length) and you will find the same to be true—precious little change.

Does your clock indicate that the rela-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tionship between the clock movement at the top and the calendar clock mechanism at the bottom has been altered? If, by re-casing or re-locating one of the movements, they have been placed a little closer together the indicated space for the pendulum will be shorter. If the original escape wheel has been changed for a wheel with one tooth less in it, that would call for a longer pendulum.

First I'd try the weakest possible suspension spring. Then get all possible weight at the very bottom of the ball, i.e. do not use any decorations or have any weight up on the rod. If these methods fail, you might address a letter to Mr. Harry Dean, 305 First Street, Ithaca, New York, and describe your clock in detail. Ithaca made several models on which the pendulum swings in front of the calendar dial.

J.E.C.

Parts for Ingraham shelf clock

Dear Mr. Coleman:

If possible, will you please let me know where I may obtain parts for an Ingraham shelf clock. I need the dial and the circular part that it is secured to. This circular part is fastened to the case and holds the dial in place. I also have this dial for another one, and I could send it in and have the dial placed on the frame for it, couldn't I?

JOHN G. KRIEGER
6615 La Jolla Boulevard
La Jolla, California

Dear Mr. Krieger:

No doubt you have already tried the manufacturer, and have been told that all such parts prior to World War II are obsolete. First, write William A. Phelps, 4106½ Glenway Avenue, Cincinnati 5, Ohio. If he cannot supply, try an advertisement in the classified section of A.H.&J. to locate a used dial and reflector rim.

Will you permit me a little story? It is completely beside the point and possibly very old stuff to you folks out there. In fact, it was quite some time ago that I first heard it, yet I never have a letter from your town that I don't recall it. It seems that a fellow from our neck of the woods went out there for a short time and upon returning talked about the town quite a

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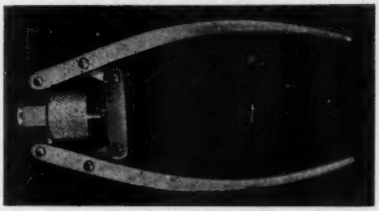

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bit, really bearing down on the "J." Then someone called his hand, reminding him that he should pronounce it "H." He replied that he was only out there during Hune and Huly—not long enough to catch on. J. E. C.

Robson and Snow clock data

Dear Mr. Coleman:

I am writing you at the suggestion of Mr. Richerg of New York City with the hope that you will be able to give me some background on two clock makers.

First, Will Snow, bearing No. 465 on the dial, oak case, 30-hour movement, flat bonnet, square brass dial, Roman numerals, Arabic seconds, raised time ring, date dial, no chimes.

Second, movement and dial by Michael Robson, County Durham, presumably English, Scotch or Irish. Brass works, brass bands, eight-day movement, hand-painted dial with moon.

Any information you can give me regarding the above will be greatly appreciated and if there is any charge for this service, let me know.

ELTON W. FORTINER
Suite 1115, National Newark Bldg.
Newark, New Jersey

Dear Mr. Fortiner:

Michael Robson: Chester-le-Street 1803 to 1812; Chester-le-Street was a small town six miles north of Durham, in County Durham.

Will Snow: Baillie lists three "William Snows." The first William Snow was at Otley about 1710 with notation "check with William Snow below." Second William Snow was at Padside in 1763. Third William Snow at Otley in 1780. Otley is nine miles northwest of Leeds, in Yorkshire. There is no further data from which to check. Though 70 years apart, it is possible that the first and third are the same man, or the third the son of the first.

The number 465 on your Snow dial has no particular meaning since we have neither a record of the method he numbered his clocks by nor any assurance that he began with number one. If the old boy was making clocks over a 70-year period, he could have easily reached No. 465. Had he made one per month, he would have reached No. 850. Evidently neither Robson or Snow did anything oustanding—at least nothing is recorded.

Regarding your last paragraph. C. & O. never makes an assessment or charge. Our principal forte is the mechanical angle. We are always too glad to help with a little history if possible. Thank you for writing. J. E. C.

Glue-on and hand-painted dials

Dear Mr. Coleman:

I have been a reader of your column since 1950 when I was in watch-making school and started subscribing to the A.H.&J. During the intervening years, I have gleaned much valuable information from your columns, and keep all copies of the journal for priceless reference material in the allied trades it represents.

I presently need help in locating hands

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for two large wall clocks—one a Seth Thomas and the other an Ingraham. The customer wishes dials with Roman numerals, which I can get. They are the glue-on type on photographic paper. Are they satisfactory? Or can they be sent and refinished like watch dials for a reasonable sum? The hands are of the French type and I am having trouble locating these. Will they have to be special made?

The customer has written the company —one or both—inquiring about hands and dials, and was informed that they no longer made such clocks. I haven't tried those places.

Also, you mentioned once in your column a good lubricant for mainsprings (clock), with headquarters in Nashville, I believe. Since reading about that, I have been unable to locate it in my past issues. I would appreciate having that address. (However, the time used in searching your previous columns was not in vain, as it gave me a good review of past problems of readers of your column.)

Any aid you can give me on the questions will be appreciated.

DEWEY D. CREACY

1232 S.W. 40
Oklahoma City 9, Oklahoma

Dear Mr. Creacy:

When properly applied with a good glue under pressure, photo paper dials can be fairly satisfactory. Some clockmakers coat them lightly with Krylon (a crystal clear plastic spray) which adds to their life. The best dial is the hand-painted dial, but the cost is a little more. For a hand-paint job, write: Edwin B. Burt, P. O. Box 65, Auburndale 66, Massachusetts.

It is noted that you say large wall clock and that you desire French type hands. The latter is a rather broad designation, and I suspect that you could probably use several of the "fancy" types. It may be necessary to make them. First write to E. & J. Swigart Co., 32 West Sixth Street, Cincinnati 2, Ohio.

For the common, eight-day, striking mantel clocks with open springs, Keystone K-V Medium is one of the best lubricants. You may order it in one pound tins from: Dr. Whitman, Nashville Machine & Supply Co., 123 Third Avenue, No., Nashville 3, Tennessee. J. E. C.

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ENICAR *Ultrasonic*

A New Cleaning and Epilamizing (Coating) Process

A special report from the Enicar Watch Co., Switzerland:

MANY watches, which are largely destined for export to remote countries with greatly varying climatic conditions, lose a lot of their accuracy after a comparatively short interval. In order to ensure that a watch keeps its accuracy over an extended period, good and precise design and construction alone are not sufficient; a very important factor is the behavior of the oil employed. If the oil changes its viscosity at certain points—and a watch has about 30 lubrication points—this will decisively affect its running. Above all, the endeavor must be made to employ an oil which changes little, or at best, not at all. Furthermore, the oil drop, if it is to perform its function properly, must not disperse from the lubrication point (spread). In view of the smallness of the droplets (about 0.5 mm. diameter) this requirement is difficult to meet. The desirable end therefore, is to ensure that the droplet actually retains its hemispherical shape, which is due to surface tension, over a period of years.

The spreading of oil is closely connected to the surface condition of the lubricating point, in particular to its purity. All kinds of dust and foreign bodies that are deposited on the surface of the jewels, promote spreading of the oil which is the very thing to avoid, since the oil will escape from the points that require lubrication. Moreover, the oil is far more subject to evaporation as soon as it has spread over larger areas, and chemical reactions (aging) occur far more easily. With respect to the cleanliness of the surfaces (particularly of the jewels), two types of impurities can be distinguished:

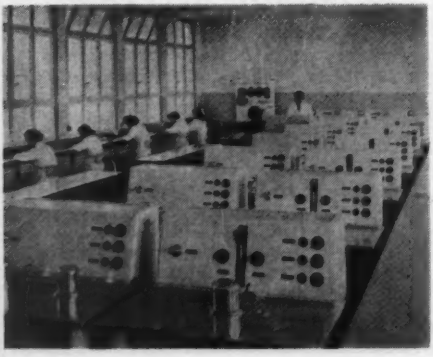
The dust particles, cellulose fibers, metal dust, etc., which are relatively easy to discern (by means of a magnifying glass or microscope), and the almost invisible residues of detergents (soap, fats, stabilizers, etc.), which usually occur in the shape of very thin films.

Even though the thin films do not cause the spreading of the oil and its chemical alteration, they promote them. Films left by soap or certain detergents may even act similarly to an epilam (coating) and prevent the oil from spreading. Such accidental epilams (coatings) are not, however, defined and are active only over limited periods so that spreading of the oil is not positively eliminated over extended periods. This type of epilam (coating) cannot be reproduced repeatedly nor controlled as to quality.

Many watchmakers believe that oil cannot spread on clean surfaces. This is not true. If oil does not spread on surfaces cleaned according to the old method, it is because one of these invisible films has been deposited in the last cleaning bath. It proves that cleaning was incomplete.

The Department for Industrial Research (AFIF) of the Federal Institute of Technology in Zurich, in collaboration with the Association of Swiss Watch Manufacturers (CIM), has developed a cleaning process based on the above discoveries, which permits the surfaces to be rendered perfectly clean. For obvious reasons, this new

A section of the Enicar laboratories



process has been reserved for exclusive use by these Swiss watch factories.

The AFIF Process

The so-called heavy impurities are removed by ultrasonic treatment, i. e. mechanically, by the new AFIF Process. A suitable arrangement of the ultrasonic oscillators permits even the smaller jewel holes (to 6/100 mm. diameter) to be cleaned perfectly. By way of example, the effect of ultrasonic waves on the surfaces of an aluminium foil is so strong that the foil is two-thirds pulverized in 162 seconds *(Figures 1 to 5)*. The cleaning action of ultrasonic waves on watch jewels is correspondingly high *(Figures 6 to 8)*. The parts to be cleaned, i. e. plates and bridges, etc., are clamped on panels and moved in the ultrasonic field at a certain speed.

The second type of impurity, i. e. the thin films of residues of all kinds, are removed by another purely physical process. The discs with the various watch parts are stacked and the entire stack repeatedly sprayed with fresh, hot detergent in a distillation system. The remarkable feature of this process is the automatic renewal of the detergent bath in which all invisible films are removed.

After this process, the parts are clean and the jewel and metal surfaces so active that every watch oil spreads very rapidly, as shown by ENICAR, S. A., which possesses a large-size plant of this type. This is a process which, as pointed out above, is undesirable *(Figures 9 to 16)*. The parts cleaned in this process must accordingly undergo further treatment in order to prevent the oil from spreading. This is achieved by the so-called:

'Epilamizing' Process

In which the surface is covered by a controlled film of fatty acid molecules causing a change in the surface tension between lubricating oil and surface so that the spreading of oil is prevented.

Hitherto "epilam" (coating) was applied by dipping or brushing. Both processes, which have been known for some time, display very substantial disadvantages, particularly in respect to the ability to reproduce the evenness and thickness of the "epilam" film. Moreover, in the portions which should be free from epilam, i. e. in the jewel bores, most epilam is deposited owing to capillary action. This causes these portions to be insufficiently lubricated by the oil. For this reason, the effect of such epilams is subject to controversy among the watch experts.

The AFIF "Epilamizing" Process operates on a fundamentally new principle. The epilam substance (chemically pure fatty acid) is applied to the parts in gas form and the epilam film formed on the surface. This process has the great advantage of ensuring a perfectly even epilam film of the most efficient thickness. The dried stacks are inserted in the epilamizing chambers after cleaning, and the parts epilamized by suitable application of the gas stream across them at an adequate temperature.

The inhibitory action of epilam in respect to the spreading of oil on a jewel or metal surface is very striking *(Figures 17 to 23)*. But a demonstration on the object itself is even more astonishing. The epilam films are so thin that they remain invisible even at very high magnification. The epilam protection against spreading of the oil remains operative over amazingly long periods, unlike the effect of epilam applied by the dipping process hitherto employed. It is obvious that a very beneficial effect is exercised with respect to aging of the oil, thickening by chemical oxidation, etc., constituting considerable progress for the Swiss watch industry.

In order to demonstrate the effect of epilam quality, the right-hand section of a metal plate was epilamized by dipping, while the left-hand side was left untreated *(Figure 24)*. A drop of Chronax oil was applied to both sections, and it was found that the oil drop, despite epilamizing by dipping, greatly increased in diameter. The originally bright red color disappeared and the oil became viscous and gummy after four years. In a further test *(Figure 25)*, the right-hand section was epilamized according to the AFIF Process, and the left-hand portion left untreated. The oil on the right-hand section (vaporized epilam) has retained its viscosity and color practically unchanged after four years. The discrepancy in the behavior of the two epilam films after the four-year period is most interesting and reveals how insignificant differences in the surface conditions may be of substantial consequence.

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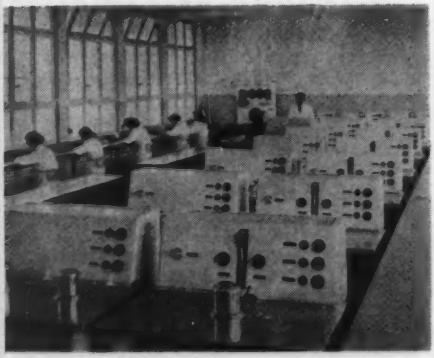

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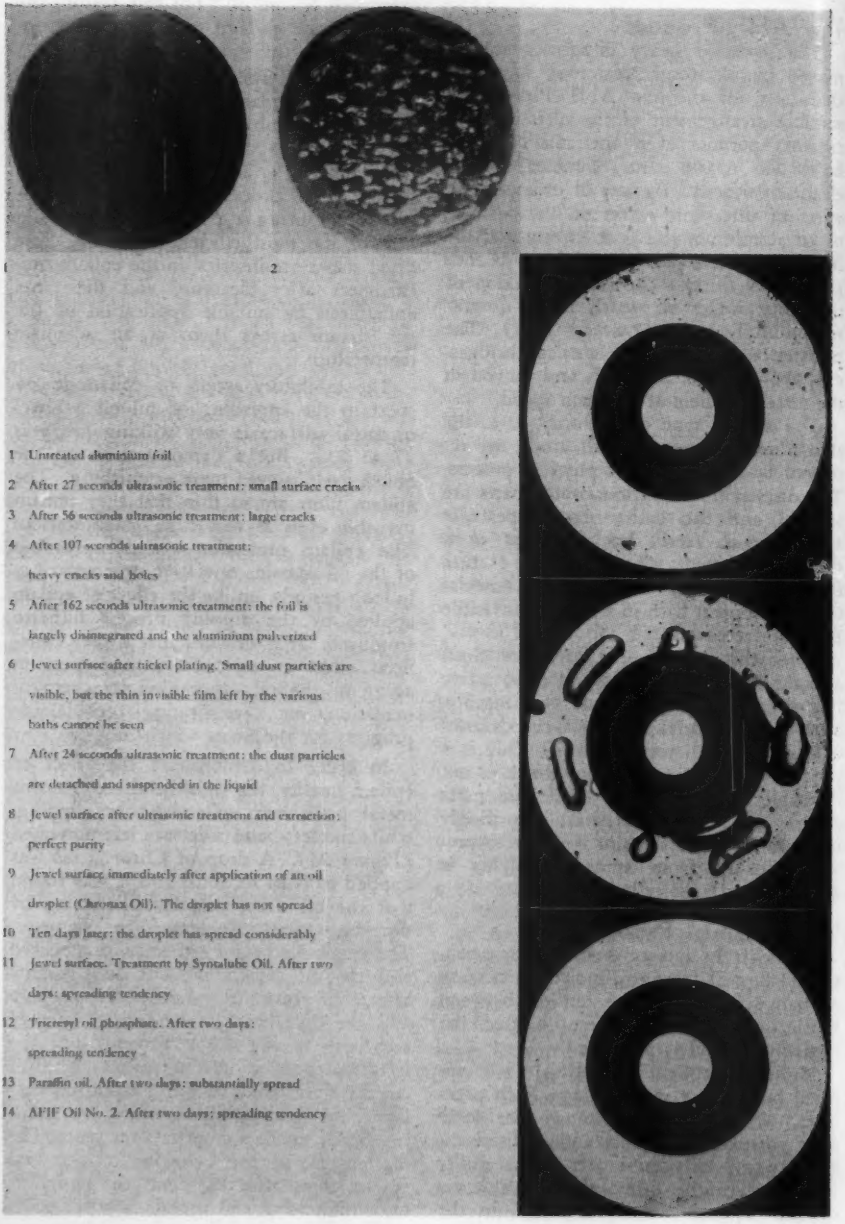


1 Untreated aluminium foil

2 After 27 seconds ultrasonic treatment: small surface cracks

3 After 56 seconds ultrasonic treatment: large cracks

4 After 107 seconds ultrasonic treatment: heavy cracks and holes

5 After 162 seconds ultrasonic treatment: the foil is largely disintegrated and the aluminium pulverized

6 Jewel surface after nickel plating. Small dust particles are visible, but the thin invisible film left by the various baths cannot be seen

7 After 24 seconds ultrasonic treatment: the dust particles are detached and suspended in the liquid

8 Jewel surface after ultrasonic treatment and extraction: perfect purity

9 Jewel surface immediately after application of an oil droplet (Chronax Oil). The droplet has not spread

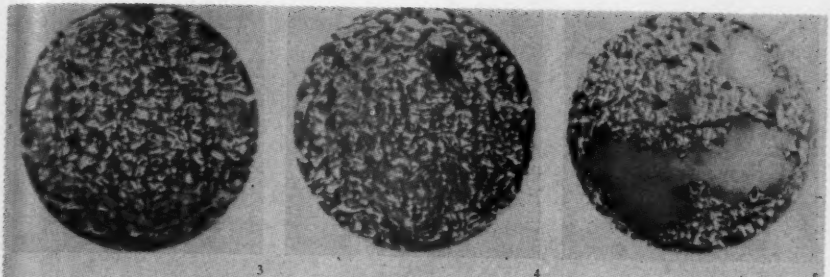
10 Ten days later: the droplet has spread considerably

11 Jewel surface. Treatment by Syntalube Oil. After two days: spreading tendency

12 Tricresyl oil phosphate. After two days: spreading tendency

13 Paraffin oil. After two days: substantially spread

14 AFIF Oil No. 2. After two days: spreading tendency



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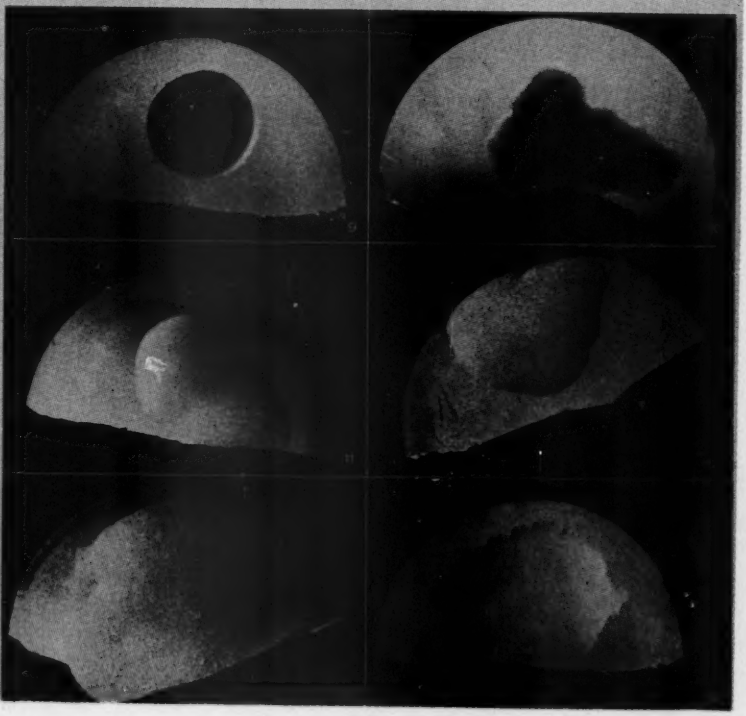
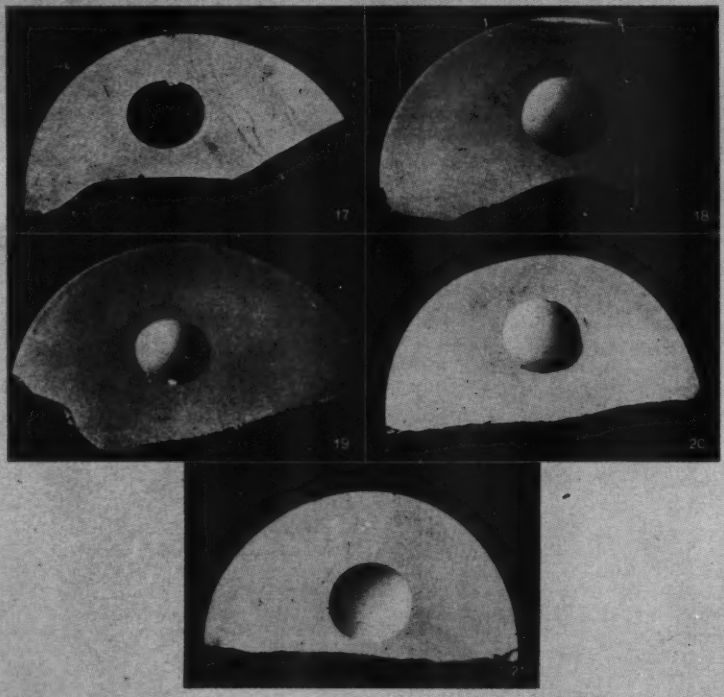


15 Syntalube Oil on gold-plated metal surface. After two hours: substantially spread

Paraffin oil on gold-plated metal surface. After two hours: substantially spread 16



17 Chronax Oil on epilamized (coated) jewel surface after 30 days
18 Syntalube Oil after 30 days
19 Tricresyl phosphate after 30 days
20 Paraffin oil after 30 days
21 APIF Oil No. 2 after 30 days

22 Syntalube Oil on metal surface after 30 days

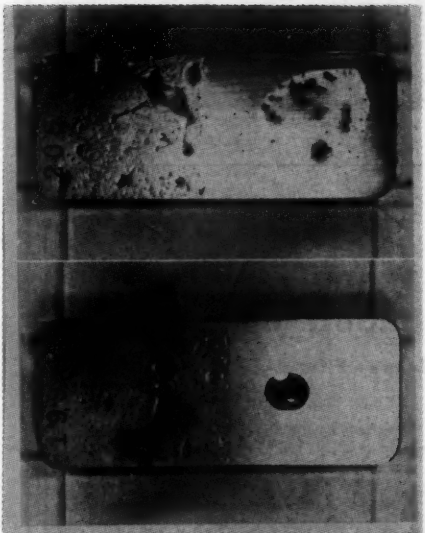
Paraffin Oil on metal surface after 30 days 23

In a second test series, analogous experiments were performed on cap-jewels. A tiny paraffin oil droplet was applied to cap-jewels cleaned by the AFIF Process. On non-epilamized (not coated) cap jewels, no trace of oil was found after ten hours (not even at 1:100 magnification). On other cap-jewels, epilamizing was effected by dipping. The oil droplets remained intact for several weeks, but spreading tendencies were found to exist after only a few months. The results after two years were as follows:

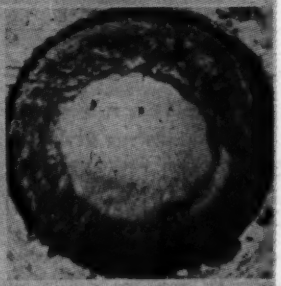
The point originally holding the oil droplet was perfectly dry and partly clean *(Figures 26 and 27)*. Peripherally, a thin film of thickened, gelatine-type oil was found.

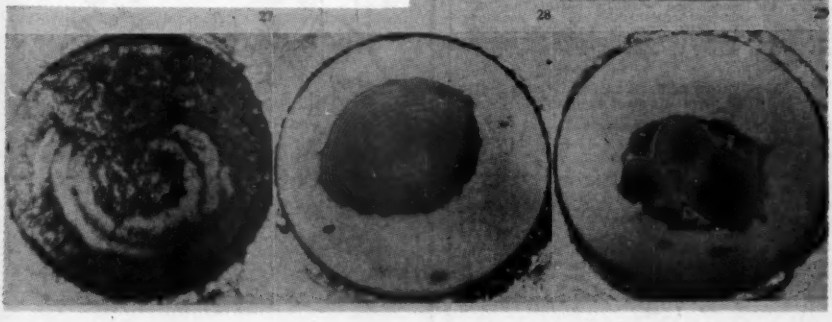
Other cap-jewels were treated by the AFIF Cleaning and Epilamizing Process and small paraffin oil droplets applied *(Figures 28 and 29)*. The droplets were somewhat thinner owing to evaporation after two years, but had retained their original viscosity. No spreading was found to have occurred (enlargement of figure: 45 times).

These tests prove incontrovertibly that epilamizing by the AFIF Process is far more efficient than dipping with respect to both spreading of the oil and its aging (chemical alteration) on jewel and metal surfaces.



24 and 25





27 28

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Let us summarize: The AFIF Cleaning and Epilamizing Process such as at present applied, comprises three individual syntonized processes. Each of these fractional processes creates the conditions necessary for the subsequent operations: The excellent epilam action is possible only if the part surfaces possess the necessary degree of purity. The proper order of operations was accomplished by providing a unit for each fractional process, viz.:

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The cleaning and epilamizing conditions are always the same for any given setting of the devices, and the results are of similar, reproduceable quality.

Thanks to the Epilamizing Process developed by AFIF and patented in Switzerland and abroad, spreading of the oil is prevented and the oil remains in its desired location.

Chemical alteration of the oil, i. e. its aging, is substantially reduced so that the lubricant does not change its viscosity over extended periods.

In this manner, a problem that has greatly occupied the minds of watch experts, both manufacturers and repairers, for years and decades, has been successfully solved.

"This stone would have been worth more if it hadn't been cut—but simply turned back to the bottling works for a refund."

Watchmakers' Contest

REMOVING METAL PARTICLES IN CLEANING

CONTEST ENTRY #92

Many times I've noticed small particles of metal clinging to the steel escape wheels after cleaning. I have solved the problem by placing a magnetized piece of steel in the cleaning baskets and running it fast in the cleaning jars. This removes the metal particles in the solution. This will eliminate many comebacks, because sometimes a pinion may be magnetized enough to cause metal particles to stick to it.

CORRECTING LOOSE-FITTING ROLLER

CONTEST ENTRY #93

Oddly, I still get a number of single roller jobs, and loose-fitting rollers are common in my shop. Some time ago, I devised this way of coping with it, and it just might be useful to others as well. I slip the roller firmly onto a brass or copper taper pin to which I apply heat to anneal the roller without oxidizing it.

Then it is a simple matter to close the hole with a round-faced solid punch. In railroad watches, I reharden and temper the roller just as a matter of principle, thought I really don't consider it necessary. In watches of lesser grades, I simply chuck it up on a steel taper pin and burnish the edge to give it hardness. The flat surfaces of the annealed roller may be easily restored to brightness by a few light passes over 4/0 emery on glass. Not as involved as it sounds, it does a more workmanlike job than most of the methods I've read of, and it certainly beats making a new staff to gain a large post.

1955 Grand Prize Winner, as determined by Judges Samelius, Coleman and Fried, is:

Claude B. Deaver, Jr., 40 Rivington Avenue, Long Branch, New Jersey, for his "Versatile Clock Tool," Contest Entry No. 56, March, 1955. He will receive a Quality Set of Five Swiss-Made Tweezers.

Winners of A. H. & J.'s Watchmaker's Contest for December:

First prize: Arnold Case Opening Wrench, to J. M. Bilgri, Box 245, Dumas, Texas, for his "Staff Makes Punch," Contest Entry No. 88.

Second prize: Algren Spring Bars, 72 Assorted Sizes, to Armand D'Addario, 40 Drew Road, Belmont, Massachusetts, for his "Screwdriver Out of Drill," Contest Entry No. 90.

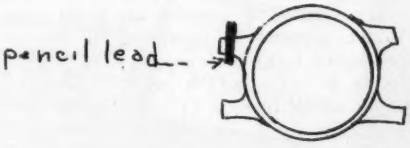
Third prize: Movement Holder and Bench Block to Woodrow Young, 221 ½ Plaza, Madill, Oklahoma, for his "Jewel Screw in Crown to Correct Short Stem," Contest Entry No. 91.

BUILDING UP WATCH CASE LUG

CONTEST ENTRY #94

Occasionally it is necessary to build up a lug on a man's watch case, where the metal has worn away enough to let the spring bar fall out. I do this by inserting a piece of pencil lead from a mechanical pencil in the spring bar hole; then soldering a piece of nickel, brass or silver over the worn part.

The lead is unaffected by the heat, leaves a nice smooth hole when the lug is filed to shape, and eliminates the necessity of redrilling the hole.



Subject of Voltage Regulation

Watch Repairman and the OSCILLOSCOPE

By Carl H. Anderson

IN OUR travels around the country, we have run into many peculiar conditions about which the boys at the bench have asked many questions. One of the most prevalent ones seems to be the subject of line voltage maintained by their local electric power company. We have received letters from readers about the way some of their electric equipment and electronic instruments operate and why they act as they do. When these conditions were investigated, we found practically three-fourths of them were due to voltage fluctuation of the power lines and not to any fault of their equipment or instruments. It is absolutely impossible for any power company to maintain a perfect voltage or anywhere near it, but this is not their fault. Most of the boys at the bench are not electricians or electronic engineers and, therefore, do not have a correct understanding of the situation. You may wonder what the subject of voltage regulation has to do with you, but you will soon find out.

In every electrical and electronic test book we have ever seen or read, where they explain voltage, amperage, wattage, resistance, capacity and the other electrical and electronic terms, they use water and a water pipe for comparison. So we will do the same as it is easier understood. We all know what is meant when we say the water pressure at the faucet on the wash basin in the workshop is 110 pounds. We mean the water inside the pipe is at a pressure of 110 pounds per square inch. Water pressure thus expressed has nothing at all to do with the quantity of water in the pipe or the reservoir, or how much water is being used during any given time. Water pressure is expressed in pounds per square inch, while the pressure of electricity is expressed in volts. Therefore, when we say there is 117 volts in the electric light wires, it is the same thing as saying the water in the pipe is at a pressure of 117 pounds per square inch.

The amperage of the electric current is the quantity of electricity available or passing a certain point in the wires. Again using water, it is the quantity of water in the pipes, reservoir, etc., which is available for use. When we say there is one ampere of electric current, it would be the same thing as saying we had a bucket with one gallon of water in it. The wattage is the quantity of electricity used, and does not state how much electricity is available or what pressure it is under.

Comparing wattage to water, it would mean that we opened the faucet until the water flows out at the rate of one gallon per hour, because wattage is always expressed as the quantity of electricity used in one hour of time. When we say we have a 100-watt lamp, we mean the lamp consumes or burns 100 watts of electricity in one hour. We all know that a pipe offers a certain amount of resistance to the flow of water. For example, if we had a pipe a mile long (regardless of the diameter of the pipe) and we put water into the pipe at one end under 100 pounds pressure per square inch, a mile away at the other end of the pipe the water would not be under 100 pounds pressure due to the resistance to the flow of the water offered by the pipe.

Electrical resistance is expressed in ohms, which means resistance the wire offers to the flow of electricity through it. Capacity means just what it says. For example, we say this is a three-gallon bucket; we mean the bucket will hold three gallons of liquid without overflowing. It does not state how much water is in the bucket, merely that it will hold three gallons of water. Capacity in electricity is the same thing. For capacity in electric circuits, we use condensers which have the faculty of storing up electricity, which can

be released instantaneously or gradually. The unit of electrical capacity is the farad. Since this unit is far too large to use in electronics, capacity is usually expressed in microfarads, which is 1/1,000th of a farad. This again is broken up into tenths, hundredths and thousandths. Thus a condenser of .01 microfarad would have a capacity of one-hundredth of a microfarad (1/100 of 1/1,000 of a farad). If we put one gallon of water in our three-gallon bucket, the bucket is filled to only one-third of its capacity, and the same thing can be said for a condenser. If we abruptly turn the bucket upside down, the water all rushes out in one big, almost instantaneous gulp; that would be discharging the electrical condenser instantaneously. On the other hand, we can pour the water out of the bucket gently and gradually until it is empty or only partially emptied. The same can be done with the electrical condenser. There are other electrical terms such as power factor, cycles, phase, reactance, inductance, KV, KVA, etc., which we need not explain as they are not so directly connected with the voltage you get at the socket at your bench in your store.

Now what causes the line voltage to fluctuate? Again we go to water. If everyone in your city were to open up all of their water faucets simultaneously until they were as wide open as possible, it would permit more water to flow out than the water pumps were capable of pumping, therefore each faucet would not give a full flow of water, but only a little trickle. Every faucet in town now being wide open, it would allow the water to flow out of the pipes quite freely and the pressure could not be maintained, therefore it would go down. Now apply that to the electric light wires in your store or home. If everyone in town were to suddenly turn on all of their lights, signs, motors, elevators, radios, TVs, flat irons, refrigerators, washers, coffee percolators, etc., the voltage would drop down until nothing would operate. The lights would go out, the motors stop, the radios cease playing, and so on. To take care of such a situation, the power company maintains extra generators, but the switchboard man at the central station could not start up an additional generator to fill the extra demand for electricity before the lights went out, the radios ceased playing, etc. As quickly as possible, he would start up additional generators and the voltage would build itself back up. Then if just as suddenly everyone turned off all their electric equipment, the voltage would jump up sky high.

Now as this affects you. Suppose someone down the street suddenly starts up a five- or ten-horsepower motor, an elevator or an electric sign with thousands of lights in it is suddenly turned on. Instantly the voltage goes down (the same as the water pressure in the pipes) and your watch cleaning machine motor, your polishing motor, etc., slow down in speed. In fact the voltage might go so low that they cease running entirely. It is exactly the same thing as when everyone in town opened their water faucets. Knowing that line voltages do vary, many manufacturers include in their electronic instruments an

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automatic voltage regulating device which uses a tube much like a radio tube. The difficulty with such devices is that they never at any time raise the voltage when it is low, but only cut down the voltage when it is high. Therefore, should your line voltage at any time fall below the minimum for which the automatic voltage device is designed, you have a voltage too low to properly operate the instrument.

Fundamental principles

While we haven't the slightest intention of even trying to give our readers a very short, short course in electricity or electronics, yet we do know that if you understand some of the fundamental principles involved you will have a better understanding of how some of your devices, motors and electronic instruments, etc., operate and why they perform as they do. The few principles which we have very briefly explained apply equally to any type of electric or electronic device, instrument, etc. Never forget that!

Let us assume for sake of illustration you have an electronic instrument which was designed for operation on 117 volts and has an automatic voltage regulating device built into it. What happens? Whenever the line voltage goes up a few volts, the automatic voltage regulating device cuts it down to somewhere near 117 volts. Remember that at all times the automatic voltage regulator *always reduces the voltage; it never increases it.* On the other hand, the voltage drops down to 110 volts, 7 volts below what it should be. The automatic voltage regulator does not entirely cease operating, it still reduces the voltage a little and it might reduce the 110 volts to 107 or 108 volts, thus further reducing the voltage from what it already was.

Now as to how this affects you. Let us say you are operating your oscilloscope and all of a sudden you notice the trace and the horizontal time base line bob or jump up on your screen, then gradually lower itself below the center of the screen and then slowly rise again to the center of the screen. At the particular instant this happened, someone whose electricity comes from the secondary winding of the same transformer from which you receive your electricity, suddenly turned on or off some electrical device, thereby either increasing or decreasing the quantity (watts) of electricity the transformer had to furnish. Just like opening the faucet—opening it, the water begins to flow and the water pressure in the pipe drops down slightly or, conversely, closing the faucet, the water ceases to flow, thereby the pressure builds up slightly. Exactly the same thing takes place with your voltage. Turning something on reduces the voltage, while turning something off increases the voltage in the line.

There is no known method by which this can be prevented and do so automatically. Therefore, there are various types of voltage regulators. Some manufacturers of electronic instruments who use the automatic voltage regulator design the working part of the instrument to work at say, 110, 105, 100, etc., volts, the theory being that the actual voltage in the line will never drop below this point, there-

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fore the automatic voltage regulator will always be reducing the voltage. If the instrument were actually designed to work at 110 volts and the line voltage never dropped that low, but was always above 110 volts, the automatic voltage regulator would reduce the voltage input to the instrument to 110 volts; therefore the instrument would operate at a satisfactory level most of the time. But let us assume the voltage went up to 125 volts. This would mean the automatic voltage regulator would have to reduce the voltage by 15 volts, which most of them will not do. In such a case, the actual input voltage to the instrument would not be 110 volts, but would be nearer 115 volts.

Just how much effect does a change of voltage make in electronic instruments? Sometimes it is quite critical and other times not so bad. Let us use a common radio as an example first, and say the radio is designed to work on 117 volts with a power transformer to furnish the "B" voltage at 750 volts across the outside terminals of the secondary winding. This means the voltage output of the secondary winding of the transformer is approximately six and one-half times the voltage input to the primary winding. Now let us suppose the line voltage at your socket went up 10 per cent. This automatically increases the secondary voltage the same 10 per cent which would be 75 volts, or in other words, from 750 volts to 825 volts. Quite a change, is it not? Well, it is enough to cause serious damage to the tubes, condensers, resistors, etc. On the other hand, let us say the line voltage went down 10 per cent. This means the secondary voltage (originally 750 volts) likewise went down the same 10 per cent, or 75 volts, which would actually give 675 volts across the secondary winding of the transformer. Most radio sets so designed will not operate satisfactorily with a "B" voltage of 675, which means the sound coming from the radio would be barely audible, or it might drop so low that one would think the radio had been turned off.

Let us apply the same to the oscilloscope or other electronic instrument. We recently addressed a meeting in one of the large cities of the country at one of the leading hotels where the line voltage was only 105 volts. What happened? When we went to show how the horizontal time base line could be expanded until it more than covered the face of a seven-inch cathode ray tube, we found that with the horizontal gain control turned up as far as it would go, we had a horizontal time base line of slightly less than five inches, thereby lacking two inches of filling the screen of the tube. Fortunately, we had a laboratory precision voltmeter sitting on the table by the side of the oscilloscope and could point out that the line voltage was down to 105 volts.

Since our oscilloscope was engineered to work on 117 volts, we were 12 volts short, or approximately 10 per cent. Now apply this to the accelerator voltage of the cathode ray tube which was designed for 1,300 volts. A 10 per cent drop in the primary voltage means the secondary voltage was 10 per cent low, or 130 volts low. This means we had only 1,170 volts on the accelerator when it should have been 1,300 volts. Apply this same thing to another popular make oscilloscope

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which uses an accelerator voltage of 4,400 volts. Ten per cent drop would be 400 volts—far too much for the oscilloscope to operate as it should. As these things affect you and the electric and electronic instruments you use, it makes all the difference in the world as to how the instrument works when different line voltages are encountered. Therefore, if you have invested several hundred dollars of your money in any type of an electronic instrument, why wouldn't it be a matter of good common sense to make sure such instrument operates on the correct line voltage for which is was designed.

Manual voltage adjuster

How about controlling the voltage at which your equipment works? This is a much simpler matter than at first you might think. We carry with us a manually-operated voltage adjuster. With this instrument, we can manually set it so that the voltage applied to the oscilloscope and other electronic instruments we carry with us is always 115 volts. This means that no matter where or how we use the instruments, they always operate just the same. These voltage adjusters are available in four different capacities: 150, 300, 600 and 1,200 watts. We carry the 300-watt size as everything we demonstrate uses slightly under 300 watts when they are all in use at the same time. We set up the oscilloscope and other electronic instruments and then when we are ready to use them, we read the voltage of the line. If the voltage is too low, we turn up the voltage adjuster, and if the voltage is too high, we turn down the voltage adjuster. If you are particular in your work and you now have several hundred dollars invested in your electronic instruments, why isn't it good practice to invest another $20 or $25 to make certain they always operate under the same conditions? Let us repeat one thing—the changes in the line voltage are positively not the fault of the electronic instrument manufacturer and neither can they be rightly said to be the fault of the local electric power company, because they cannot possibly maintain an even voltage.

The instrument we carry on the road with us is rather small. It is 8 inches long, 4 inches wide and 5¼ inches high, weighing possibly 10 or 15 pounds, as it contains a lot of copper wire and core iron. On the front of the instrument is a knob and a dial. The dial is marked off in 10-volt steps from 60 to 140 volts, thus—60, 70, 80, 90, 100, 110, 120, 130 and 140. On the top of the instrument, there is a built-in voltmeter, which shows the voltage the instrument is delivering to whatever electrical device or electronic instrument is connected to it. The meter reads from 50 to 150 volts in 5-volt steps. While the meter scale shows only 150 volts, by turning the knob on the front, the voltage can be boosted up to more than 250 volts, or lowered to around 60 volts. The particular thing we like about this manual volt-

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age adjuster is that it will either raise or lower the voltage for you. From this, we see that should we be connected to an electric line where the voltage was only 60 volts, we can set the knob on the front of the instrument to deliver up to 250 volts to whatever is connected to it, or down to 60 volts.

Just what does all of this mean to you? It means, if you have been having trouble with any of your small motors, electrical devices, electronic instruments, etc., that you can control the voltage yourself to whatever amount is necessary to make the device operate as you wish it. Therefore, if you have some kind of an electrical device or electronic instrument which should operate on a line voltage of 117 volts, you can adjust the knob on the front of the instrument until you have 117 volts. You then know the instrument is operating properly at the correct voltage at which the engineers designed it to operate. We have never at any time in the past recommended anything to you with a clearer conscience than we can a manual voltage regulator.

Free bulletins

For those who are interested, we have mimeographed 500 special bulletins about this instrument, how to use it, what to use it for, etc. We will send one of these bulletins free, by return mail, to each of the first 500 who write us in care of A.H.&J. in Denver and ask for it. All we ask is that you send us a 3-cent stamp to pay the return postage, and we do not think that is asking you too much. We will make you a present of the mimeographing cost, stenographic work, etc. This bulletin is not an advertisement by us or anyone else, and definitely is not intended as such. The information given in the bulletin will apply equally to any manually-operated voltage adjuster.

In previous articles we have mentioned the resuming and recovery rates of a watch without explaining what they were or how to ascertain them. We have said that our National Bureau of Standards in their tests of railroad grade watches for a certificate allow an error of 12 seconds per 24 hours between any two of five positions, while they allow a resuming error of only 4 seconds. Thus it is seen they require a resuming rate exactly four times better than the position rate. We have said that these rates are a part of what determines the kind of time a watch keeps on your customer's wrist or in his pocket. To this we would now like to add the third rate, which we do not believe we have mentioned heretofore in our articles and that is the disturbance rate. You know without our telling you that a watch worn on the wrist is almost constantly in motion, therefore the motion of the balance is disturbed. This very definitely affects the timekeeping qualities of the watch. We have also mimeographed 500 special bulletins on these three rates, telling you what they are and how to ascertain them. We will send one free to the first 500 readers who ask for it.

You can have either or both of these special bulletins by addressing us in care of the American Horologist and Jeweler, P. O. Box 7127, Capitol Hill Station, Denver 6, Colorado, and asking for them. But be sure to enclose a 3-cent stamp to pay the return postage. Please do not send a stamped, self-addressed envelope—just the 3-cent stamp. Either or both of these bulletins will be sent free to the first 500 who ask for them, which will exhaust the supply. So, if you want either or both of them, better write right now before the other fellow beats you to it. Let us say in passing that neither of these bulletins is any form of advertisement. We wrote both of them ourselves and they are not obtainable elsewhere. Do not address your request for these bulletins to us at our Lexington, Kentucky, address. *It must be sent to Denver.*

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Learning to do stone setting without personal instruction

THERE continues to be an unusual amount of interest shown in stone-setting and everyone appears to be faced with the same problem—the problem of not being able to receive personal instruction. Many jewelers or jeweler-watchmakers with whom I have recently spoken have such a keen desire to learn the art that their inability to receive adequate instruction must be frustrating to say the least.

Many owners of small jewelry stores have found that to set their own stones not only "clinches" many a sale, but also adds considerably to their prestige and, as a result, builds more diamond business. Many find that the time involved sending the work to a trade shop is often inconvenient to the customer, who might be tempted to try elsewhere.

Many jewelers are very familiar with the operations of stone setting but seem to need just that added touch of personal instruction to give them the "know-how" they feel they must have.

Since receiving this personal instruction will always be impossible for some jewelers, we will try in this department to present the next best thing—more pictures or diagrams in an effort to show each operation. This has been presented previously here, but not in such minute detail as we will attempt in this issue. It would appear that anyone with an intense desire to learn stone-setting could learn from many detailed sketches and compare his results by observing similar setting jobs from diamonds in stock.

The "flat-top" type of setting will be discussed first since it is by far the most difficult to learn.

Figure 1 shows a direct view of a diamond in a flat-top setting—without milgraining.

Figure 2 shows the beginning "V" cut used to isolate the bead prior to using the round graver. This cut is executed with a knife-edge graver or thin square graver.

Figure 3 shows the method of holding the No. 52 round graver prior to the bead raising operation.

And, speaking of bead raising, the term is misleading, as the next few illustrations will prove. What actually happens is the forcing of a bit of metal downward and over the edge of the diamond's girdle. The trimming away of the surplus metal gives the finished bead a raised appearance.

The No. 52 round graver is shaped bluntly, as shown in the side view, *Figure 4*. To begin "raising" the bead, the tip of the graver is placed in the position shown in *Figure 3a*. The tool is rocked from side to side to start the cut. Then, using the same rocking motion, the position of the graver is elevated as shown in *Figure 4*. *Figure 5* shows the final position of the round graver with the bead pressed flush to the stone. One point to remember in using the round graver—the shape of

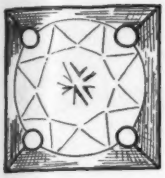

Fig. 1

Fig. 2

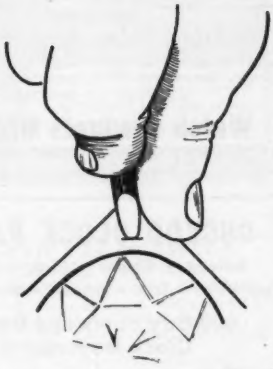

Fig. 3

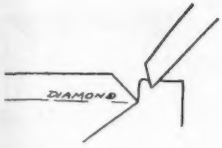

Fig. 3a

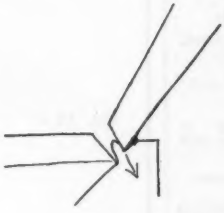

Fig. 4

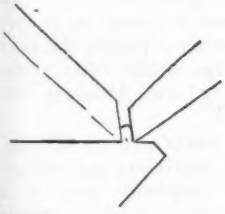

Fig. 5

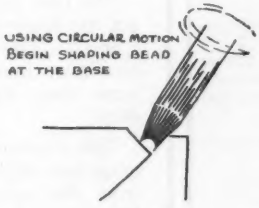

Fig. 6

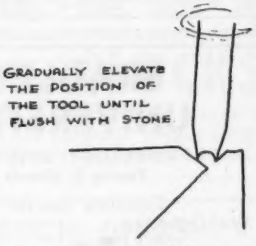

Fig. 7

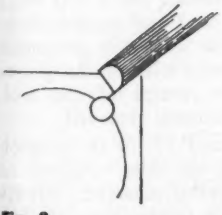

Fig. 8

Fig. 9

Fig. 10

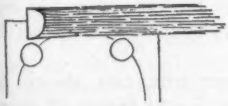

Fig. 11

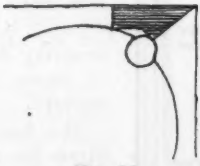

Fig. 12

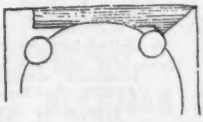

Fig. 13

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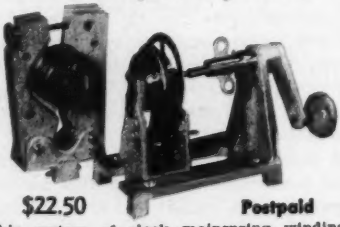

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Fig. 14

Fig. 15

the blunt face automatically pushes the bead over the edge of the girdle as the point is forced deeper into the metal.

The next step is to shape the bead, using the beading tool as shown in *Figures 6* and *7*. This operation presses the bead even more firmly against the stone, at the same time shaping and polishing the metal.

The remaining procedures are all trimming and shaping operations and will receive the greatest emphasis, since it is here that beginners usually become "bogged down."

Using a No. 40 flat graver, begin to trim as shown in *Figure 8*. This must be very carefully controlled for a slip could easily remove the bead and possibly damage the edge of the stone. A great deal of practice is necessary with the flat graver to acquire perfect control of the tool. *Figure 9* shows the metal removed.

See *Figures 10* and *11* for the position used for trimming the sides. *Figures 12* and *13* show the metal removed. Always remember to make many light, shallow cuts in trimming away metal, rather than deep cuts.

Figure 14 shows the position used for removing metal in the far corner. *Figure 15* shows the appearance after metal is removed.

The final corner trim cuts shown in *Figure 16*, *Figure 17* and *Figure 18* show the final result of the cuts.

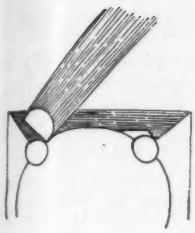

Fig. 16

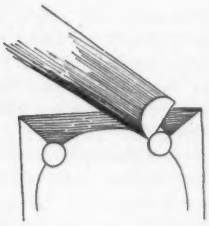

Fig. 17

Fig. 18

Fig. 19

At this point, particularly, the condition of the graver should be restored to a sharp edge and a bright polish. The final cuts on this area should leave a bright luster so that polishing on the lathe is unnecessary. This may sound difficult, but it is certainly a desired effect.

Buffing settings will always round edges no matter how lightly they are touched to the buff. A master stone-setter can trim out his settings so that buffing them would detract from the appearance rather than enhance it. A highly polished graver will leave a bright cut, and smooth cuts will leave a perfectly flat surface.

On the larger stones, it is often desirable to use a triple bead cluster in each corner rather than the conventional single bead. See *Figure 19*. Two beads do the

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work of holding the stone; the third is merely ornamental.

If a double row of milgraining is wanted, a knife-edge graver may be used, as shown in *Figure 20,* to form two sharp edges. *Figure 21* shows a cross-section view—the arrow at *"a"* shows the groove cut by the graver, the arrow at *"b"* shows the beveled edge formed by a jeweler's barette file.

In *Figure 22,* we see the milgrain tool following the sharp edges. The tool is held firmly to avoid slipping and is carefully moved back and forth over the edge or track. Caution—this operation should not be overdone. First, advance the tool along the track for a short distance, then reverse the motion or back track. Advance the tool a little farther and back track again slightly. By advancing the tool a little farther each time, a clean, sharp row of milgraining will result. To overwork the edges will cause a flattened, undefined row of indentations hardly resembling a thin row of beads.

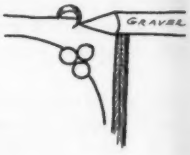

Fig. 20

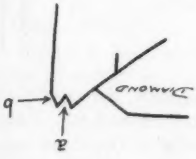

Fig. 21

Fig. 22

The foregoing discussion is fairly short in relation to the many illustrations used. The Chinese saying that "one picture is worth a thousand words" may be the answer we are looking for in learning to do stone-setting without personal instruction. At any rate, this department is open for suggestions on the subject and if there is any particular phase of work that you readers would like illustrated more fully, please write and state your case.

As an example, in this issue we have discussed the setting of a diamond in a flat-top mounting from an entirely different slant. The emphasis was on the trimming after the stone was set. In previous issues, we have dealt in detail with the measuring of the stone and the sinking of the burr, all very important operations which can be explained almost without illustration. This issue begins with raising the bead.

Later, we will discuss various phases of other types of setting jobs, using a series of drawings in an effort to clear up all fine little details that may have been missed by dealing with the subject too broadly.

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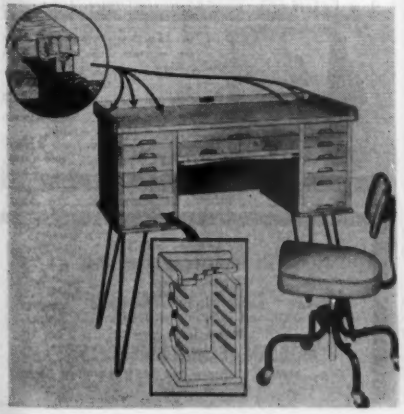

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as well as walnut to meet the modern trend in store furniture. Marshall representatives claim it to be an ideal estimate bench since it has an all-round exterior finish and can be placed out in full view or in with any counter arrangement.

The manufacturer believes that new features the bench incorporates will suit the requirements of every watchmaker. Special features pointed out by the Marshall Company include metal runners on which drawers slide to allow smooth drawer operation as illustrated in the photograph. The bench is manufactured from solid kiln dried maple. Despite its modern look, it is full 15 drawers, the most popular size. New type metal clips, also shown in illustration, with ¾-inch double screws, are used to anchor bench top and bottom down. This is done in addition to being glued and gives much greater support to the bench construction. Modern ½-inch wrought iron legs were designed for the bench to make cleaning around the base easier and also to allow good ventilation.

Other important features of the bench claimed by the company include a working surface equipped with guard rail, a grooved front edge to keep items from rolling off the bench top, canvas apron and modern rim molding that rounds out all corners to eliminate the hazard of bumped knees.

Proof that fifty years is a long time to wait for an all-new designed watchmaker's bench to appear on the market lies in the fact that after the bench was shown at conventions and gift shows, the demand to date overshadows the supply. However, production is now being stepped up to meet these increasing demands.

To accompany the new watchmaker's bench, the Marshall Company offers their new swivel posture chair shown here with the bench. The upholstery is in natural leather-like Tuflex to blend with both the natural or walnut finish of the bench. Marshall claims point out that the chair's foam rubber cushioned seat and adjustable back rest provide a comfortable sitting posture throughout the day.

Further information can be obtained by writing to C. & E. Marshall Company, Box 7737, Chicago 80, Illinois, or any distributor of C. & E. Marshall Company.

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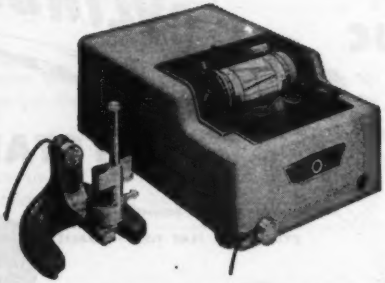

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